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IMPROVING THE SCHOOL ENVIRONMENT.

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GUIDELINES FOR CREATING IMPROVED EDUCATIONAL ENVIRONMENTS ARE PRESENTED WITH SUPPLEMENTARY DRAWINGS, DIAGRAMS, AND PHOTOGRAPHS. POLICY DECISIONS ARE RELATED TO--(1) THE SCHOOL'S RESPONSIBILITY TO THE FUTURE, (2) INDUSTRY'S RULE IN EDUCATION, AND (3) BUILDING PROGRAM RESPONSIBILITIES. EDUCATIONAL PLANNING IS DISCUSSED IN TERMS OF--(1) ART FACILITIES, (2) EDUCATIONAL SPECIFICATION DEVELOPMENT, (3) SCIENCE FACILITIES, (4) GUIDANCE FACILITIES, (5) PHYSICAL EDUCATION FACILITIES, AND (6) SCHOOL CAFETERIAS. PHYSICAL CONTROL FUNCTIONS ARE DEVELOPED ACCORDING TO--(1) PHYSICAL FACTORS AFFECTING CLASSROOM ENVIRONMENT, (2) MEETING INDIVIDUAL CLASSROOM NEEDS, (3) IMPROVED VIEWING CONDITIONS, AND (4) MECHANICAL SYSTEM IMPLEMENTATION. FUNCTIONAL DESIGN IS EXPLAINED IN TERMS OF--(1) CRITERIA FOR CHANGING SCHOOL DESIGN NEEDS, (2) EXAMPLES OF LOCAL AREA SCHOOLS, AND (3) AESTHETIC FUNCTIONS. EDUCATIONAL TELEVISION IS DISCUSSED WITH REGARD TO USAGE AND EVALUATION. (MH)

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IMPROVING THE SCHOOL ENVIRONMENT

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PRESENTED BY

THE SCHOOL PLANNING LABORATORY

SCHOOL OF EDUCATION, STANFORD UNIVERSITY

James D. MacConnell

DIRECTOR

A SCHOOL PLANNING LABORATORY PUBLICATION

DECEMBER, 1956

STANFORD, CALIFORNIA

FROM THE EDITORS . . .

Every day of the year planners, designers, manufacturers and builders bend their efforts toward improving the school environment through their services or development of ideas and new products. The training, research, and leadership program of the School Planning Laboratory is designed to assist educators with their share of this same effort.

"Improving the School Environment" is an appropriate theme for this publication which contains the proceedings and related activities of our Sixth Annual School Planning Institute. This is in keeping with our policy of publishing research findings, survey reports, and conference proceedings which are of value to those concerned with school building problems.

In the past it has been possible to publish these proceedings in their entirety and make them available at cost. However, increased publication costs coupled with the greater interest and participation in this year's conference make it no longer feasible for us to publish the entire proceedings. As a result we have edited extensively, excluding all but the most important portions of each presentation, and avoided repetition where possible without sacrificing continuity.

In so doing we have been able to present "Improving the School Environment" without increasing the per copy price. We hope you will find it helpful in improving your school environment.

R. C. S. - J. S. P.

A MESSAGE FROM OUR DEAN . . .

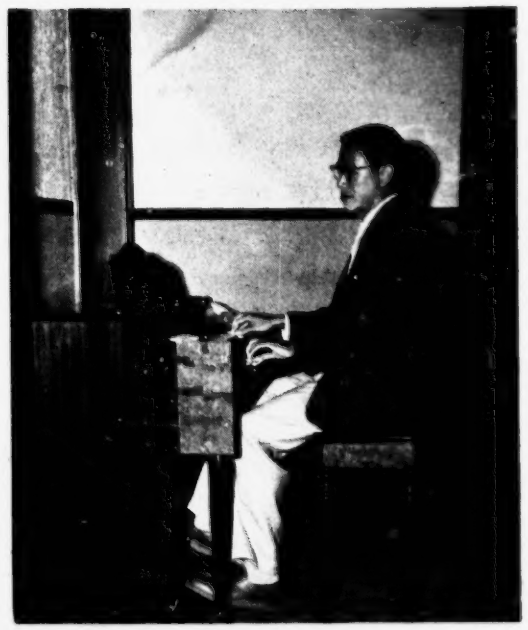
I. JAMES QUILLEN, Dean
School of Education

The school planning institutes of the Stanford University School of Education have succeeded in establishing cooperation among the many specialists concerned with the school building program. Those in attendance at the Sixth Annual School Planning Institute held in 1956 agreed that it established a high-water mark in school planning. The program was broad in scope and the participants contributed to the ideas developed through effective discussion techniques. The Stanford School Planning Laboratory and the foyer of the School of Education Building were used for extensive exhibits of building materials, equipment, architectural plans, and models of school buildings. I am pleased that the school planning institutes are continuing to make significant contributions to the improvement of school buildings in an era of rapidly expanding school populations and programs.

Stanford, California
October, 1956

MUSIC INSPIRES PEOPLE . . .

ERIC MITCHELL chats with Adrian TerLouw of Eastman Kodak Company about photo coverage at the proceedings.



BILL WATSON provided organ music at each session.

. . . PHOTOGRAPHY RECORDS THEIR ACTIVITIES

FOREWORD

The task of the educator today, though a tremendous one, pales in significance when compared to that which he must prepare himself to face in the foreseeable future. He must preserve, transmit, and add to a continually expanding body of skills, techniques, and information for a constantly growing school population.

Preparing citizens for our democratic and urban-industrial society demands knowledge, skills, abilities, and attitudes which exceeds the expectations of educators fifty years ago.

Our grade schools and institutions of higher learning are charged with the responsibility of providing a dynamic learning environment and trained personnel in which to develop the changing technical and social skills required by the students. However, in order to continue to do the job well, in the face of continually increasing demands, it will be necessary to increase the efficiency of the operation of our school staff and facilities as well.

A flood of new students has been pouring into our elementary schools, and will soon hit our secondary schools and colleges. Just prior to World War II there were but two million children born per year. Since that time the number has risen to approximately four million per year. Elementary school enrollments jumped from approximately twenty million in the school year 1945-46 to nearly thirty million for the school year 1955-56. Secondary school enrollments, on the other hand, have not shown such a marked growth during this decade as have the elementary. There were approximately six million in high school during the school year 1945-46 and approximately seven million this past year. However, during the next three or four years you will witness much greater increases at the secondary level.

In addition to school enrollment increases, which are due to rising birth-rates, there have been increases due to 1) advances in medicine, 2) improvements in standard of living, and 3) a tendency for more people to attend school for a greater number of years. For example, in 1900, there were less than 12 percent of the 14-17 year olds attending high school as contrasted with the nearly 80 percent in 1955-56.

All of this growth means that within the next four years we will have to build about 700,000 new classrooms and train more than 750,000 new teachers.

These needs, together with an ever-increasing competition for the financial support of our schools, reinforce the urgency with which we must explore the range of possibilities which may increase the total educational efficiency. It is the aim of the School Planning Laboratory of the School of Education at Stanford University, through its research, conferences, and publications to assist in this exploration.

James D. MacConnell
Director

Table of Contents

Part			Page
1	Policy Decisions	The Schools' Responsibility to the Future	3
		Industry's Role in Education	6
		Boardsmanship in the School Building Program	9
		The Superintendent's Role in the Building Program	11
		Our Greatest Task	17
		. . . Or Equal	20
2	Educational Planning	Developing the Educational Specifications	25
		Planning Science Facilities	30
		Planning Guidance Facilities	32
		Planning Art Facilities	34
		Planning Physical Education Facilities	39
		Planning Secondary School Cafeterias	43
3	Physical Control	Physical Factors Affecting the Classroom Environment	49
		Meeting the Child's Classroom Needs	53
		Improved Viewing Conditions	56
		An Approach to Physical Control of the Learning Environment	59
		Air Conditioning and Long-Range Planning	63
		Master Controlling the Environment	66
4	Functional Design	Criteria for Changing Needs in School Design	73
		A Presentation of Some Schools Recently Designed and Constructed in the San Francisco Bay Area	74
		Function of Esthetics	95
5	Educational Television	Experimental Classroom Television Paves the Way	101
		Classroom TV Break-thru	103
		Installation Criteria and Facilities Needed for Classroom TV	104
		Questions from Those Who Attended the TV Demonstration	106
		What's Right with Our Schools?	116

part 1

improving the school environment through

POLICY DECISIONS

San Francisco Examiner

Scenes From The School Planning Laboratory

SURVEY REPORTS

COMPILED BY THE CONSULTANTS OF THE SCHOOL OF EDUCATION'S SCHOOL PLANNING LABORATORY CONSTITUTE A MAJOR ACTIVITY OF THE OFFICE STAFF. HERE DR. JAMES D. MacCONNELL REVIEWS THE PROGRESS OF A REPORT WITH MRS. HELEN SIMPSON, OFFICE MANAGER. MRS. SIMPSON PREPARED THE COPY FOR "IMPROVING THE SCHOOL ENVIRONMENT."

No. 1

THE SCHOOLS' RESPONSIBILITY TO THE FUTURE

JORDAN L. LARSON, Past President AASA
and Superintendent, Mount Vernon Schools,
New York.

We are living in the most thrilling period in all human history. The unfolding of the manifold mysteries of science in recent years has been little less than miraculous. The incredible of a short time ago has become routine today. Before any strong plan for the future can be developed, it is necessary that we look back at the foundations on which such plans must be built in education as well as in government or in other institutions for the development of mankind. From our past experience we can harvest the best of our scientific inventions, literature, and culture. We can, from our great heritage, feast upon the fruits of all of the philosophies and blessings that have come to us from the great men and women of the past. Hence, we can well look back. On the other hand, we cannot be content to live only in the glory of the past.

We need to <u>look ahead</u>.

Upon attempting to present some thought-provoking suggestions concerning the schools' responsibility to the future, I suggest ten points for our consideration. There may be others of equal significance and some may have more merit than others. The order of priority is not necessarily in sequence, yet I trust some of these, at least, may open up further discussion and action as may appear feasible.

In considering the future, we must:

<u>Emphasize Values in Education</u>

We who are engaged in the profession of teaching should be the first to recognize the importance of education and the munificent values obtained from the process of education. We must first sell ourselves on such importance through a thorough knowledge of values not only in each of our communities but on the broadest possible level. We need to be as proud of our schools and their significance as industry is proud of its new products and as television producers are proud of their

new shows. This does not necessarily mean that we need to brag about our schools. Rather, we need to better understand these values and be so well informed of their over-all significance that we generate in others our kind of pride. To do this we need to utilize terms that have common meanings which do not create confusion and misunderstanding on the part of our communities' citizens.

Awaken Public Concern for Education

While it may be important to emphasize values in education, this is but preliminary to awakening a public concern for it. Too many people have too long taken our schools for granted. They have not been alerted to the dangers facing our schools, such as the inadequacies of our buildings, both in the old and the need for the new. The critical shortage of well qualified teachers is another danger that has not penetrated deeply enough into our society. There are others including all the critical aspects of education. These must be continually emphasized. We must awaken in the leaders in business, industry, and government, at all levels, a deep concern for the welfare of their children and the schools which they attend. Through this awakening, a strong spirit of cooperation toward achieving and maintaining better schools could be created.

Increase the Thirst for Knowledge

One of the things we have skimmed over too lightly has been the creation of that thirst for knowledge which would yield the optimum in attendance and reduce dropouts to a minimum. We need also to create this same thirst for knowledge on the part of adults. The responsibility of the schools is then to quench such a thirst in a sound program of adult education. Such knowledge might include up-grading in the vocations and in social and civic training. The schools should take a prominent part in making the desire to learn as important as learning itself. This should hold, as well, for international understandings and exchange of ideas.

Meet the Manpower Needs

One of the great problems in American society is the need for an inventory of our human resources. An analysis of the types and numbers of people needed to meet the manpower shortages in all fields. A national emergency exists until we discover those areas in which we are short of trained personnel. We cannot hurriedly try to fill the gaps by hasty and inadequate preparation. We need the joint efforts of all agencies and institutions and organizations, including our federal government, to prepare an inventory of our available manpower. We need to determine and predict, as far as possible, the needs of the future within such time as our schools can provide the training to meet such manpower needs. This is a challenge which the schools cannot ignore and in which they should take a major part.

Speed Up the Lag in Progress

Over the years one of the difficulties in education has been to put across in our school programs those new ideas which have been invented by professional educators. Someone has said that it takes approximately fifty years for a new idea to permeate the schools of our country. In a period of such rapid industrial progress, this lag is much too great. We need to provide the means through which we can speed up our progress in education comparable at least with that which pre-

vails in the fields of science, business, and industry, for example. The exchange of "know-how" in education requires better communication throughout our profession, more rapid experimentation to determine the values of new inventions, and the action by schools to adopt them fast enough to keep up with the times.

Gear the Curriculum to Current Needs

It is urgent that we gear our curriculum to current progress in its scientific, economic, political, and social aspects. This can be done in many ways. It should start as early in the elementary program as possible. Merely taking physics or geometry is not enough. Rather, science and air-age education should carry through the entire school curriculum. In such a program any appraisal or evaluation should be made more in terms of meeting the needs of the predictable future and less in terms of the traditional past. In this we cannot overlook the need for higher standards in all phases of teaching and learning, and the facilities for housing these processes.

Accelerate the Learning Process

We need to discover the gifts of every child in our schools and encourage him in the further development of his own special skills and abilities. We need to study ways in which to accelerate the learning process. There is much more to be learned today than ever before. School programs through high school generally require a broad knowledge of the foundations of learning as well as the fundamental processes. It is essential therefore that curriculum content be increased and learning accelerated for today's students to absorb the essential offerings of a modern program. The major problem is to acquire as much learning as we can in a given period of time. Our colleges have seen fit to extend this time in many of the professional courses by one, two, or three years. This may be a sound practice. To try to shorten the period of time our children now spend in elementary and secondary schools is in direct conflict with what we want and expect to achieve. An expanded and accelerated curriculum should not ignore the exceptional child; rather it should demand that each one achieve up to his maximum capacity and that any special talents that may be discovered be given special consideration by the schools.

Increase the Quality of Teachers

In a time like this when there is such a critical national shortage of teachers, we have had little time to emphasize their quality; rather we have been willing to accept almost anyone who presented proper certification and who was willing to come into our school systems. Our responsibility for the future, however, requires that we emphasize quality in our teachers so that we may secure the best available talent for this important profession. We need this to afford our children their rightful place in the consideration of their educational training.

Develop Dynamic Leadership

Our present educational leaders need to find and develop outstanding leadership potential from among their ranks. We need these people to establish the strength through effective leadership which is urgently needed now and in the years ahead. In this pushbutton age, we are still in need of people who are willing to work diligently on the problem of educational leadership which will produce the kind of people needed to grasp educational problems in this age of automation.

Secure Increased Financial Support

This support is predicated on several assumptions: 1) that schools are recognized for their true importance, 2) that we have awakened in the public the proper concern for them, 3) that we have met the manpower needs and geared our curriculum to modern requirements, and 4) that we have accelerated our learning and increased the quality of our teachers. Were it possible to superimpose these assumptions on a dynamic educational leadership, we could and should be able to secure for our schools the kind of financial support they sorely need, now and in the years to come. Hence, as we look ahead, we further assume that achieving these ends is the primary responsibility of our schools. The professional career educator must bear the burden imposed by his community to this end.

INDUSTRY'S ROLE IN EDUCATION

CHARLES S. STOCK, Finance Chairman, School Facilities Council

What is industry's real role in education? How can education take advantage of the part industry plays in the attainment of better schools--well-planned schools that will actually aid education?

With educators, whenever an attempt to establish the role of industry in education is made, someone is sure to step forward and protest that industry must not become involved. With such an attitude toward industry, he will maintain that industry's only purpose in life is to sell its product. And thus, industry's only interest in education can be in the money it can squeeze out of schools. Nothing else, he will say, counts! But educators should ask themselves this question. "Is industry's only reason for being interested in our schools purely one of immediate gain?" Perhaps not.

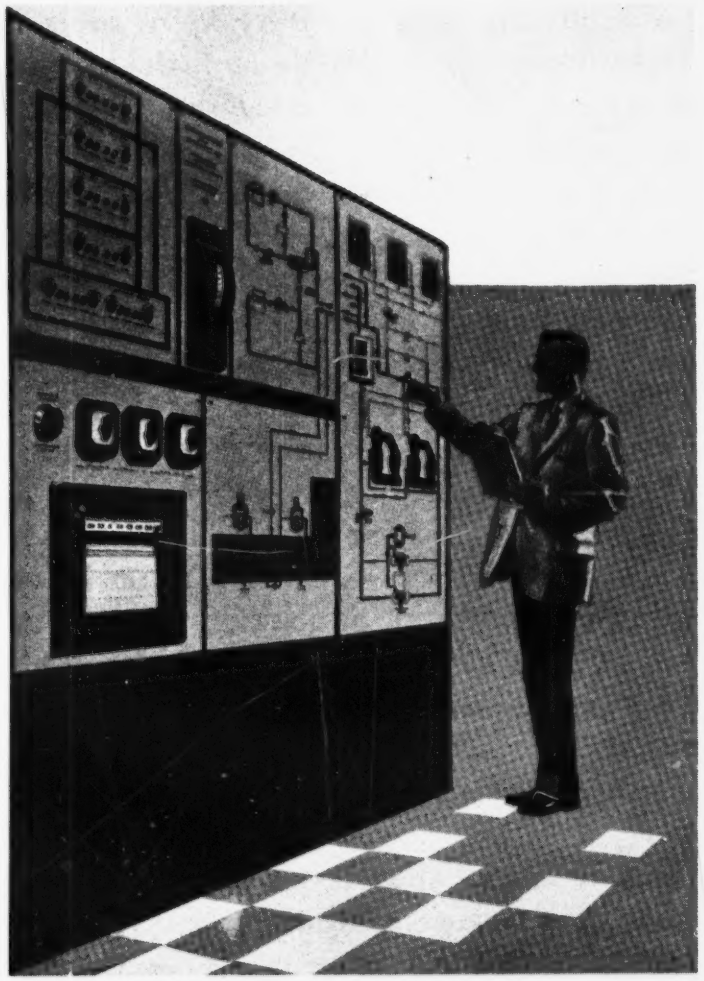
Let us consider the viewpoint of industry. From a cold, economic viewpoint, industry could do better to direct its attention elsewhere. Compared to a gross national product of more than 387.5 billion dollars in 1955, only 2.4 billion dollars was spent on school construction. And this includes not only products sold to schools, but labor, property and other costs as well. It adds up to much less than one-half of one percent of industry's sales. A very insignificant amount.

Well, then, if industry's interest in education cannot be for immediate gain, why does it bother itself with the problems of our schools? There are at least four important reasons.

Industry Depends upon Education

Industry depends upon education to train its personnel. And an adequately-educated labor force is vitally important to industry both in assuring continued growth and productivity, and in reducing production and sales costs.

Today, as you know, there is an ever increasing demand for technically-trained personnel. The production and utilization of atomic energy alone has introduced a whole new area of complexity into business



Some of the newest schools are using Supervisory Data Centers for controlling their physical environment and communications. An instantaneous check may be made of any room or group of rooms. If conditions are found to be inadequate, a reset switch is used to balance the total environment. Classes may also be proctored by closed circuit TV. Industry played the major role in developing this data center.

and industry. Electronics, cybernetics, automation--these, and many more, represent tremendous new sciences that demand new skills. It is no secret that more and more engineers are being needed each year to fill research, design, development and production capacities in industry. Industry would soon become decadent without the progress in products engendered by these young educated individuals.

And industry's need for educated young people to fill other capacities is just as important. Artisans, salesmen, mechanics, accountants, secretaries, writers, --all with skills that have had their beginning in our schools. For it is only our schools that can develop and nurture the fundamental talents upon which these skills are built. Yes, industry could get along without its sales to schools. But it is obvious that industry would be in bad shape without a steady stream of better educated young people to fill its personnel needs.

Industry Looks to Education

A second reason why industry should be interested in education is that to be successful, industry must grow. And industry's growth depends directly upon an expanding economy with a higher and higher standard of living. Industry looks to education to continually raise our standard of living. How? By increasing our ability to produce, of course. And by increasing our facilities for making better use of what is produced. To put it plainly, people who are better educated are more valuable to society. They earn more, want more, spend more, enjoy more, are more.

A recent survey by the United States Bureau of Census concludes income levels throughout the United States are closely related to levels of education. For there is a direct relationship between education level and earning power and, therefore, buying power, in our total American economy.

Industry Needs Education for Survival

A third reason why industry should be vitally concerned with education is that in this country, industry has a great stake in maintaining a free economy. With

communism ever threatening to dominate the world, we cannot ignore the importance of education in this area. According to Neil McElroy, chairman of the White House Conference on Education:

> There are plenty of hardheaded reasons why this nation needs the best in education. As everyone knows, the free world is engaged in grim competition with the communist world. To a large degree, the battle may be decided in schools. In the United States our whole course of action is decided by the voters and, in the long run, the schools will help to determine whether our decisions will be ignorant or wise.
>
> A more immediate reason is that the Communists are very much aware of the need to produce enough good scientists, engineers and all other technicians upon whom modern society depends. The task of our own schools is more difficult because we try to give every individual the kind of education he wants, instead of concentrating on those skills most needed by the nation.
>
> I have no doubt that in the long run our policy will turn out to be best for the nation as well as for individuals. But we cannot afford to let the Communists get ahead of us in science for even a little while. We need good schools for survival as well as for the fulfillment of our ideals.

Industry Requires Educated Children

Finally, industry depends upon education to teach their children. Consider for a moment, the number of persons in industry who are parents and thus are interested in education because they have or will have children attending schools. These fathers and mothers, like all fathers and mothers, want the best education possible for their children. And like all well-informed parents, they realize that the best education is not possible without the best teachers, the finest teaching tools and the most efficient schools.

As you can see, industry has a very real interest in education. In fact, this discussion could just as appropriately be titled, "The Role of Education in Industry." Industry needs the product of education--tomorrow. Yet industry can help you today.

People in industry--as highly educated men and women--can make their knowledge, their experience and equipment available to education--if education will let them. They can serve on advisory committees. They can provide needed research in their laboratories. They can put their staff at education's disposal in a cooperative venture toward improving the school environment.

The fact is clear that if we are to reach our common objective of a better education for our young people, education and industry must work together. For we each have an important part to contribute--but only a part. We must combine our existing knowledge, information and materials into a solid foundation upon which the building of the best schools is assured. With both of us trusting in each other and working together, I believe, in the end, our only disagreement will be in each of us claiming that he benefitted most.

BOARDSMANSHIP IN THE SCHOOL BUILDING PROGRAM

(L to R) J. ROLAND INGRAHAM, Assistant Superintendent, Inglewood Unified School District

MRS. ELIZABETH HUDSON, President, California School Boards Association

EVERETT LANDON, Board Member, San Mateo Union High School District

LAWRENCE WHITE, Executive Secretary, California School Boards Association

PAUL WONG, Schmidts, Hardman & Wong, Architects, Berkeley

MRS. J. FRANK SNOWDEN, Legislature Chairman, California Congress of Parents and Teachers

CARL MUNCK, Board of Education, Oakland City Schools

JAMES D. MacCONNELL, Director of School Planning Laboratory and Associate Professor of Education, Stanford University, Moderator (not shown)

The Board has the responsibility for making final decisions in policy matters but has an obligation to take into account the wishes of school personnel, parents, taxpayers, and other community groups. The effectiveness of the Board in relation to the school building program can be enhanced if there is:

A. Understanding of the educational program which has been developed to provide the best instruction for the children. Such information can be secured through discussions with and prepared reports from school personnel.

B. A Master Plan for the building program for at least five years ahead. However, such a program must bear constant scrutiny so that current factors can be entered and the program modified as required. It may involve reorganization of the district, and implies careful selection of the architect(s) and early site acquisition.

C. Extensive cooperative planning with school personnel and with the community. Time must be provided for such planning and, insofar as possible, released time given school personnel for this job. Care must be taken that this planning does not extend over into architectural planning.

D. A continuous flow of information from the schools to the community rather than spasmodic 'emergency' releases which are made only when a bond issue is pending.

E. Bids are awarded at a time when the greatest economies can be effected.

THE ARCHITECT

The advantageous selection of an architect for a district depends on careful screening and evaluation of several different firms. Consideration must be given to reputation, quality of previous work, and apparent ability to meet the needs of the district in question. After screening of all applicants, it is probably desirable to interview the top three and make the selection from among them.

Various architectural societies have recommended fees, which are generally accepted. However, certain school districts (e.g., Long Beach, California) have developed graduated scales which are acceptable and workable as far as the Board is concerned. New construction ranges from 8% for a $300,000 plant down to 4% for $2,500,000, while re-use of plans varies from 4% for $300,000 to 1-1/2% for $1,000,000 or more. Generally, the re-use of plans within a district is satisfactory provided previous errors are not continued, the plans are educationally satisfactory, and modifications are made for site and location differences with a full fee for major changes. There appears to be little justification for the use of regional or state-wide stock plans. A reaction by architects to the graduated scale, as well as to the re-use of plans, is that service is related to fee and that any reduction in fee results in a lessening of service.

AREAS OF BOARD RESPONSIBILITY IN THE BUILDING PROGRAM

1. With the help of community groups and under the leadership of the administration, the board must develop and adopt a philosophy of education which will serve as a base for the total educational enterprise.

2. A Master Plan, based on a careful community analysis, must be developed and adopted.

3. Priorities and sequential needs must be determined.

4. An architect must be selected.

5. Sites must be selected and acquired. Architectural and engineering help will be required in this phase.

6. The educational program, in harmony with No. 1, must be determined broadly through wide community, board, and professional participation.

7. Educational specifications, spelling out the educational program and needs in considerable detail, should be prepared for the architect.

8. Preliminary plans, as developed from the adopted educational program and educational specifications, should be referred back to the board for consideration.

9. Definite plans and working drawings should be studied carefully by the board prior to submittal for various agency approvals.

10. Bids must be advertised and contracts awarded.

11. Frequent site visitation, during the construction period, is desirable.

12. A final inspection, by the entire board, should be made.

13. The plant should be dedicated, with appropriate ceremonies, and the school personnel oriented to its use.

14. Visitation and evaluation of the plant in use should be made to determine the strong and weak points.

THE SUPERINTENDENT'S ROLE IN THE BUILDING PROGRAM

(L to R) KEITH GOLDHAMMER, Acting Assistant Professor of Education, Stanford University, Moderator

JAMES W. DENT, Superintendent, Mt. Diablo Unified School District

NEIL M. PARSONS, Superintendent, Acalanes Union High School District

GEORGE D. MINER, Superintendent, Richmond Public Schools

Mount Diablo Unified School District, Concord, California

The Mt. Diablo Unified School District, located in central Contra Costa County about 25 miles east of Berkeley, is experiencing a tremendous population increase.

The 150 square mile district, unified in 1949, brought together twelve separate elementary districts and the Mt. Diablo Union High School District. The enrollment at the time of unification was 6,400 pupils. The enrollment in June, 1956, was over 20,000. An additional 10,000 pupils are expected in the next four years.

The construction program has included two new high schools, four new intermediate (7th and 8th grade) schools, twelve new elementary schools, and a school for cerebral palsied children. By 1960 three additional high schools, four intermediate schools, and six elementary schools will be required, plus additions to many of the thirty existing schools.

The building program has been financed from local, state, and federal sources. Local bond issues have totaled $10,650,000; state aid has totaled over $9,000,000; federal aid (Public Law 815) has totaled over $2,500,000.

Building needs during the next six years are estimated to require approximately $16,000,000 in new financing.

The responsibilities of the superintendent in such a large building program are many and varied. He is presumed to have some knowledge of planning, real estate, taxation, finance, school buildings, heating, lighting, and the relationship of all these things to the educational program for which he is primarily responsible.

Actually, the superintendent is the coordinator of the activities of many individuals, since it would be impossible for him to be expert in all phases of the school

building program.

The superintendent of a growing district must devote time to long-range planning, enrollment projections, and population trends, in order to foresee future building needs and to acquire necessary sites. This involves close cooperation with city and county planning commissions and with individual subdividers. It is a continuous process of revising estimates as quickly as new data becomes available.

The superintendent is responsible for keeping the Board of Education and the general public continually aware of the building needs of the district. Frequent reports to the public through every means of communication available helps to insure passage of needed bond issues.

Districts involved in state or federal aid find a great deal of time consumed in working with the agencies involved. When constructive suggestions can be made, the superintendent should strive to improve the existing procedures by offering his criticisms professionally and through proper channels.

The matter of educational planning for the school plant is one of the best examples of the superintendent's role as coordinator. He cannot be expected to be expert in all subject fields, and will make use of recommendations by teachers' committees, by consultants in special areas, and by other members of his staff. Working with these people and with the architect, the superintendent will develop plans which will be functionally sound and which he can recommend for the Board's consideration.

Close cooperation between the architect and the superintendent is a must during the progress of the building program. Because of the volume of building projects (67 in the past six years), the Mt. Diablo District has a somewhat unique arrangement with their architects. Four firms have formed an association. The district deals with the association and not with the individual firms. To date the agreement has been mutually satisfactory, since the work load can be distributed among the four firms depending upon their current volume of business, insuring quick service for the school district. A chairman elected by the architects serves as liaison with the superintendent.

It is to be recognized that the role of the superintendent is to coordinate and to recommend. The final decisions rest with the Board of Education. The success of a building program will be determined in large measure by the degree of cooperation shown by all parties concerned.

Richmond Elementary and Union High School Districts,
Richmond, California

The school district which has not developed a district-wide master plan during this period of rapid school expansion will find itself in dire straits to say the least. And the superintendent who has not provided for master planning in his district will find himself in plenty of trouble or he will be looking for another job.

Master planning for a district, especially a district which is growing rapidly or which has a shifting population, involves a considerable dexterity on the part of those people who are responsible for such planning. Population trends and shifts must be determined as early as possible in order that adequate facilities may be ready to meet the surge in enrollments in changing areas. Such predictions are difficult and hazardous to make. However, it must be recognized that despite extreme care it is possible for these forecasts to become inaccurate almost overnight when rapid development takes place.

Master planning, of necessity, involves educational philosophy which must become a major factor in the planning of future facilities for a district. A district's philosophy can and does change. Therefore, good master planning must be flexible enough to meet the concurrent changes in the district's needs. The administrator is frequently placed in a hazardous position while attempting to keep ahead of a growing and shifting population. Projecting enrollments in such an area is extremely difficult.

We are in the process of completing a survey of future school needs for the Richmond school districts. This survey is being conducted by an independent agency which is one of the best ways for a school system to obtain more accurate estimates of future needs. This is particularly true where a district is lacking in properly trained staff people for such an undertaking.

Once the needs have been projected it is then possible to proceed to select adequate sites for future growth. This becomes a particularly vexing problem in large city districts where improved land must be acquired. This is an expensive process. In developing areas it is possible to purchase unimproved land at a greatly reduced cost compared with improved land in a developed area. Although we have found it necessary to purchase more than twelve school sites in the past ten years we have not had one single condemnation suit go into court. Adhering to optimum site size standards is very difficult in a metropolitan area. We have found it necessary to build schools which are needed in certain areas on sites which fall short of these standards. This is not good practice but it is frequently unavoidable.

Master planning for each plant is just as important to the welfare of the district as master planning for the entire district. It is necessary for the administrator to know the ultimate location and capacity of each plant planned in this manner. He needs to know many other factors, such as, what is going to be taught in the plant, how long it may be needed in that particular area, and what facilities would best serve to fill the total needs of the students in the proposed attendance unit.

We have had, for many years, an unstable and temporary population in Richmond which is just now reaching the vanishing point. It was necessary to plan several temporary schools which could be moved from one area to another. In addition, movable classrooms were constructed on certain existing sites to accommodate the children living in a temporary World War II housing area. As these war housing units have been razed, we have effected the movement of entire school plants to new locations to care for subsequent shifts in enrollments.

It has been advantageous in our system to have had someone who has had considerable background in school plant planning to work closely with the planners. A knowledge of engineering or architecture is essential to real planning and the ability to look at sets of plans with a knowledge of what they mean is most helpful.

The next step in our building program was the educational planning of the details of the building. We found it advantageous to use planning committees of our professional staff. Our people have worked long and diligently to develop a handbook for planning of general spaces and of special spaces. Specialists have been used extensively in the latter phase for the planning of science, homemaking, library, gymnasium, shop, office and other special spaces. In addition to our staff and specialists from county and state educational departments, outside consultants were employed to supplement and coordinate our planning with the districts' architects.

We have spent, during the past ten years in our

two districts, nearly 24 million dollars on a program of new construction, reconstruction, and remodeling. The responsibility for the correct spending of this amount of public funds is terrific. Without the money the most minutely planned program cannot be achieved. In Richmond we were fortunate in having two bond issues passed by the electors. We were eligible for quite a sizeable amount of federal aid and, up to the present, were able to raise a little money for the building program out of current funds.

We are now faced with an ever increasing burden created by a recent re-assessment and a sharp decline in equalization aid from the state. With mounting tax rates and increased assessed valuations we are again faced with a bond issue and subsequent increase in the tax rate to finance the program which we have envisioned for the next ten years of growth.

Our situation is probably typical of many school districts in California. More and more of the burden of school support is being shifted from the state to the local school district. If we are to maintain our present educational program and our present relatively high salary schedules it is going to be necessary to raise more money just to finance the present program.

One of the most important phases of any school program is that of the public relations involved. In our particular situation it is necessary for the administration to deal with two separate boards of education. There is a board for our high school district which contains four elementary school districts and four incorporated cities, there is also a board of education for our city school district wherein two incorporated cities are involved. In addition to working with two boards of education which employ a common superintendent it is necessary for the administration to deal with many other governmental agencies all of which are interested in school planning. There are four city councils, city and county planning commissions, a housing authority, and a re-development agency. Cooperation with these agencies and a good working relationship with them must be maintained. Once this working relationship is established it is necessary for some one staff member to keep his finger on the pulse of each of these agencies at all times in order to know what is going on in the district. In addition to these public agencies there are the usual organizations present in all districts which may have a good or bad effect on any planned program such as P. T.A., Taxpayers Association and others with which you are all familiar.

In closing I would like to add that the administrator of a school system must be all things to all people but certainly he must be concerned about the functional use of school buildings after they are complete. He must determine that they are the proper type for the educational program involved, that the spaces as designed are used to the fullest extent, that they fit the needs of the district at present and in the foreseeable future. In other words it is difficult to imagine a superintendent of schools who is able to provide beautiful, modern, functional, school plants and then have little or no concern about what is being taught in those buildings.

Acalanes Union High School District, Lafayette, California

My discussion of the topic will be related rather specifically to the school district with which I am connected--the Acalanes Union High School District. This district is situated in West Central Contra Costa County. It adjoins Oakland, Berkeley, and Richmond on the

west. The district includes four distinct communities and five elementary school districts. The area is comprised of approximately 65 square miles. The present population is approximately 60,000, is suburban residential in character with over 90 percent of the heads of families commuting daily to San Francisco, Oakland, and Berkeley, through the two-lane, half-mile long Broadway Tunnel. There were slightly over 500 pupils in attendance at one high school at the end of the war in 1945. There are now 2,700 in three high schools. We expect to have an enrollment of well over 5,000 in four more years and plan to have five high schools in operation by 1960. The terrain of the district is rugged; it being made up of a succession of steep hills and valleys, and the ambition of each new resident seems to be to build on a "view lot" on top of a steep hill and then dare the school busses of the area to come up and pick up his children.

Our problems are not different than the problems faced by many school districts today except in one or two particulars. We are in a very rapidly growing area. We must acquire school sites for the immediate present and the future, and we must provide school buildings to take care of the high school pupils who are knocking at our doors in ever increasing numbers. In respect to the matter of sites and buildings, it should immediately become apparent that long range planning is of the utmost importance. It cannot be overemphasized that a district must know what it is facing before it can make plans to solve its problems.

We saw the handwriting on the wall immediately after the end of World War II. In 1946, a planning consultant was retained and the following year we had his report covering district population trends, elementary school enrollments, potential high school enrollment, the existing school plant, the educational program, a program for plant development, and financing our long range building program. Without this study, we would not have recognized what faced us even though the predictions at that time were far too conservative. In the intervening years, the information contained in the first long range building study has been kept up to date. Within the past year, two new independent surveys have been made. Thus, we were aware years ago what we would face the following year or five years in the future and could plan long in advance to meet the problem.

The superintendent has a distinct responsibility in recommending to the Board that such studies be undertaken if they cannot be made by himself or by a member of his staff, and that they be kept up to date. It should be through his recommendation and analysis that the Board and the community are ready to plan and act early enough so that the coming pupils may be accommodated. In our district, it has been known for many years that September, 1956 would see an increase in enrollment of 500 over the previous year.

In these days of rapid community development with subdivisions extending in all directions, early acquisition of sites is of prime importance. Many of us are familiar with what happened in a nearby rapidly growing high school district. It recently made application to the state for over $1,000,000 to purchase a 40-acre site which then had over 100 homes built on it.

Mention was made that in one or two particulars, the planning problems of our district might depart a little from the usual. One is that we must take into account the educational program and planning of our component elementary districts. Several of them have now gone into a program of upper grade or intermediate schools consisting of the seventh and eighth grades. We must have close articulation to see that facilities for certain types of instruction are not duplicated. Another, is that because we are building high schools in rather rapid succession, we are asking the architect for our

fourth school -- to design it in such a manner that much of the work will not have to be repeated for the fifth school to come along two years later, with a resultant savings to the district.

In financing the building program, it should be the superintendent's role to determine what district resources are available -- what funds may be raised from bonds or from taxes or from both, and if outside aid will be necessary. Based upon the information he provides, the board may then lay out a program as to how it proposes to finance necessary building, and eventually submit this program to the people. In our district, it was determined early that we could provide necessary housing without outside aid until approximately 1958, at which time it was expected that the rate of increase in assessed valuation would be falling considerably behind the rate of increase of enrollment. It was not a question of determining whether we would build from bonds or on a pay-as-you-go plan; we knew it would take both. During the past eight years, since 1948, our district has been bonded to the limit year by year as well as taxed 30 to 50 cents on the operational tax rate annually for building purposes. Bond elections were held in 1947, 1950, 1952, and 1956. Beginning in 1950, the people authorized bonds several years in advance of our capacity to sell them. Currently, we have about $3,000,000 in advance authorization plus authorization to borrow $600,000 from the state to buy school sites in advance. Because the district has been bonded to its limit practically since its formation, our building program has had to be on a piecemeal basis; that is, we have built annually, or we might say that building has never stopped. We let contracts as money becomes available each year from tax or bond sources. Typically, a high school plant in our district is being built over a period of about five years. Our schools at the present time are enrolling the ninth grade the first year and adding one grade each year.

The superintendent's relations with the architect are a most important part of this building procedure. After the board has selected an architect it is important that the superintendent becomes well-acquainted with him and his firm that there may be an easy flow of ideas back and forth. It is necessary that there be mutual respect and understanding of each other's problems and decisions.

A superintendent will undoubtedly involve the school staff in the planning program and will be responsible for the selection of the staff members who will compose committees, for scheduling meetings with him, and with the architect. There are both advantages and disadvantages in using staff members in planning buildings. Drawbacks may be (a) A teacher's committee may well be dominated by one person. Does he know the new trends and materials in his field? (b) Many times teachers will plan more space for his department or classroom than can be financed. He will want to have more storage space or built-in fixtures than should be allowed. (c) With the best of intentions, staff members will sometimes request the type of facilities that might suit them well but will not satisfy the desires of the people who actually use the space in the end. However, the advantages of staff participation in the planning process certainly outweigh the disadvantages for the people who do the instruction -- who work in the classroom -- know the general requirements of their activities. They have a knowledge of many details not realized by the superintendent or the architect. Then too, there are certainly values to the staff member himself in becoming involved in the planning program. He has a hand in the planning of the new school, his opinion is needed; he has a sense of importance, and it does something very positive for his morale. In addition it encourages him to examine in detail what he is doing in the classroom, how he is doing it and

perhaps how it could be done better or easier.

Providing the architect with educational specifications for the school plant to be designed is one of the necessary and important phases of the superintendent's responsibility in the building program. In the development of these specifications he should have whatever assistance is available, for today's superintendent is called upon to do many things. He is no longer only an "educator". Rather, he has become a manager. The typical superintendent accepts the responsibility for seeing that pupils are fed, so he is in the restaurant business; that they are transported, which puts him in the bus business, and for seeing that they are housed, so he is in the planning and construction business.

If planning consultants are available from the County Superintendent of Schools' office, he should make use of them. He should get what help is provided by the state. If there is not sufficient help from these sources, and usually funds do not permit these agencies to furnish sufficient, the district should look elsewhere. If a district is going to spend millions on its building program, it is poor economy not to be willing to spend a fraction of a percent to get whatever outside help and guidance may be available. Many times, too, the people will accept the judgment of disinterested consultants quicker than their own local representatives. In our district we have made use of consultants from the beginning of our post-war building program and feel amply repaid for the small cost to the district.

Certainly the superintendent must be the leader and coordinator of the building program. It should be his recommendations which initiate planning and financing. He keeps the program going through his recommendations to the board. He is in the center of a square which has the board in one corner, architect in another, community in a third, and the staff and planning consultants in the other. He sees that all are kept informed and proper action taken so that the new school will open its doors on September 1.

OUR GREATEST TASK

DONALD DOYLE, Assemblyman,
California Stale Legislature

The problem of building enough schools for our growing school-age population remains, as you know, one of the most pressing tasks facing our state and nation's educators and public alike. I will not dwell on statistics relative to the over-crowding of our country's educational facilities; yet I should like to outline briefly the scope of this school building problem.

It is not the school construction program alone that challenges California. Only 10 percent of the state's education funds are spent for construction; the other 90 percent is spent on personnel, services, and supplies.

It is to the huge task of providing enough school construction to accommodate the increase in the number of students facing us today, that I would like to direct my principal remarks.

I would like to present four specific aspects of the school building problem that I think are quite relevant:

The first of these involves organization of overall responsibility. The second involves the problem of local responsibility. The third concerns an analysis of causes of delay in building construction. And the fourth involves certain concepts of economy which need evaluation in order to help the building job along.

The first of these four parts of the problem--organization--was given added importance recently by the defeat in the Congress of a bill to provide federal funds for school construction. It has served to emphasize the importance of setting up thorough-going and permanent state programs of school building aid to school districts.

We should recognize, I think, that our shortage of classrooms is a long-term condition rather than a temporary one. Here in California, for instance, the state government has been attempting to handle the school building aid program on an emergency basis, whereas this problem has been with us since the end of World War II and promises to present a challenge for many years in the future. Such a state-aid program should operate, then, according to a definite policy by which the state would participate in construction assistance according to a systematic, continuing plan.

As you may know, a subcommittee on Public School Construction Costs, operating as a unit of the California State Assembly Interim Committee on Education, earlier this year issued a report in which it recommended that a program of state aid for school construction be administered by a single agency operating under policy direction of a State School Building commission.

Concerning the second of these four points--involving local responsibility--I feel we must redouble our efforts to insure that the local school districts and the counties, units of government long recognized as in the best position to discharge the responsibility for school construction, as well as the administration of the schools generally, be brought more closely into the planning phase of the job.

Also, I would like to point out that the State Assembly subcommittee on construction costs has suggested that existing bonding limits applying to school districts at certain levels be made more flexible in order to provide needed school building without state aid. A recommendation also was made to provide for improvements in legislation concerning lease-purchase of permanent classrooms and school buildings.

On the third of these four points--concerning project delays--I think there is need to revise the state's system for internal control of school-building money which, to an increasing extent, has become an impediment to building our urgently needed classrooms in the shortest possible time.

Here in California we could save approximately three months in planning and construction time simply through administrative action and the modification of certain procedural rules and regulations. These improvements would involve simplification of administrative responsibilities and relationships between the various state departments and agencies concerned with building aid.

It was interesting to note that among the Assembly subcommittee's recommendations was one which pinpointed specific areas of responsibility. It was recommended, generally, that the determination of elements of the architectural program for proposed school building projects rests solely with the State Department of Education. It was also recommended that the approval of maximum costs of such projects rest with the Department of Finance, and that the approval of fire and struc-

tural safety features of projects remain with the State Division of Architecture. Another recommendation called for the lifting of certain time and estimate restrictions on projecting construction need in districts with unusually rapid population growth.

Still another called for the streamlining of the processing of school district applications for building aid through the advancement of site acquisitions and master planning funds, the advancement of funds for the preparation of detailed plans and specifications and other services preliminary to construction, the simultaneous checking of plans and specifications by the school planning and allocation agencies as well as the Division of Architecture, and a general speeding-up of apportionment of funds. In this connection, it should be pointed out that local applicant school district officials should be reminded that they can make use of federal funds now available for the preparation of preliminary plans for building projects.

My fourth and final point concerns economies and the architect. The question of economies has been the occasion for controversy in the past, and it looks as though it will continue to be so in the future. Involved here are such problems as reasonableness or equity with respect to architectural fees charged on school construction projects, and various so-called "short-cuts" such as the re-use of plans for classrooms and school buildings. Although I am not qualified to speak of school design and building, I do feel, as a member of the State Legislature, that I can say a word or two about these so-called economies.

For one thing, I believe the California Council of Architects has done much to correct a mistaken impression left in some minds that the problem of construction costs in this state--or in any other state--centers about the compensation of the architect charged with school designing . . . or that excessive fees are impeding the effort to build schools for the growing school population. Certain well-meaning people, who are not at all familiar with the important role of the architect in school building projects, have criticized the fee items in public school construction costs, and, I think, quite without justification.

There are people, more informed with respect to the need and the complexity and variableness of professional design attention for each individual school design problem, who may quite understandably be looking for assurance that the school architect is being as moderate as possible in the planning of buildings to be financed with public monies. This urge to effect economies has led other well-meaning people down the garden path of plan re-use. There is danger, I think, in giving any support to the idea of using so-called "stock" school plans or "repetition of plans" to effect economies in the over-all school design and planning program. I believe the architects' observation that "stock plans might work if you also provide a stock site" is a point well taken. We must rely upon the architect to protect our school building program from these false economies.

Summing up, then, we have these four timing and planning items having to do with the tremendous job of building adequate schools for our expanding school population--responsible organization, effective local action, expediting the job, and exercising proper economies. This school-building task will be with us for some time to come, but knowing this--and gearing our techniques to the reality of the situation--each one of us concerned with school planning can get the job done.

. . . OR EQUAL

CHARLES L. HEMMINGS, Deputy District Attorney, Contra Costa County

The process of decision making is predicated upon district policy. Much discussion ensues in board meetings concerning those two little words--or equal. This phrase frequently raises the question, "What constitutes equality of a substituted item?" I will attempt to clarify some of the legal aspects of school purchasing through presentation of certain relevant case studies.

With particular reference to purchases of school furniture and similar equipment, it is essential that a definite specification be decided upon before further steps are taken. School administrators who are in doubt as to an appropriate specification can secure assistance from either the district's architect, or from the business houses which supply school furniture.

When bids are called for, the specifications and other documents should definitely state the required time of delivery, the terms of payment, and if bidding is permitted on an "or equal" basis, how the question of equality of a substituted item shall be determined.

It is entirely proper and legal to state that bids will be received on a particular manufacturer's item identifying it by catalog number or otherwise. Other bidders may bid on other items of a different make providing that they substantially comply with the call for bids.

Fisher, et al. v. Borough of Longport, et al.

53 Atlantic (2d) 210,211

The portion of the specifications, material for decision, provides as follows:

> "1. Work to be Done: The work to be done includes the construction of a Gravel Filter well unit, Layne type or equal, complete with pumping equipment and auxiliary engine drive having a guaranteed minimum capacity of not less than 700 GPM against a surface pressure of not in excess of 25 feet, all as hereinafter specified: # # #."

It would seem that a careful reading of the above-quoted portion of the specifications does not preclude competitive bidding so as to bar any bid except that of the defendant Layne-New York Company, Inc. Albeit the specifications call for a "Layne type" gravel filter well unit; provision is therein made for other types of equipment by the use of the words "or equal". To hold otherwise would be to do violence to plain and simple English.

The time of delivery specified in the call for bids should not be so short as to favor certain suppliers over others. Generally speaking, a period of at least 30 days for delivery should be allowed to the successful bidder.

In certain circumstances, it will be required that bids be called for on a particular furniture item without the privilege of substituting an equal item. Such a case, for example, is where additional student desks are being purchased for a classroom which is partially equipped.

On the other hand, when a new school is being furnished, it seems proper to throw the bidding open to all bidders who can meet the specifications adopted by the school district.

In the State of California, school districts, under the authority conferred by Section 18054 of the Education Code, can annually award a contract to supply such school furniture as becomes necessary. Ordinarily, suppliers quote a lower figure on large volume purchases. Suppliers should be given an opportunity to state in their bid proposals what discounts will be available to the school district on large purchases as compared to smaller ones.

California school districts that are securing aid from the Local Allocation Division of the Department of Finance must comply with paragraph E of Bulletin No. 10 issued by the Local Allocation Division on September 1, 1953. This bulletin contains an excellent summary of the principles which should be followed in calling for bids on school furniture and related equipment.

The governing board of a school district has fairly broad discretion in determining what type of furniture best fits the needs of the district. From time to time questions have been raised as to the legal validity of "or equal" bidding. The governing board of a school district has a broad discretion in determining the needs of the district. In the absence of fraud, the honest judgment of the governing board of a school district will not be disturbed by a court.

Plaintiff appeals from the judgment and first argues that school boards, as such, in the State of California have no authority to reject the lowest bidder's bid without rejecting all bids. This argument is without merit. Section 18051 of the Education Code provides as follows:

> "The governing board of any school district shall let any contracts involving an expenditure of more than five hundred dollars ($500) for work to be done or for materials to the lowest responsible bidder who shall give such security as the board requires, or else reject all bids. This section applies to all materials and supplies whether patented or otherwise."

This section requires a school board to award a construction contract such as is here involved to the lowest responsible bidder. In Cyr v. White, 83 Cal. App. 2d 22, 28 (187 P. 2d 834), the court, in considering the meaning of the term "lowest responsible bidder" as used in city charters, said (quoting from West v. Oakland, 30 Cal. App. 556 (159 P. 202):

Raymond vs. Fresno City Unified School District

123 C.A. 2d, pp. 628-630

> " ' . . . There are many occasions in the experiences of municipal government when the quality of the thing to be supplied in the course of the public service depends upon conditions which differentiate bidders, and require the exercise of a sound discretion on the part of city officials in determining whether the wares or device which each individual bidder offers in the form of his own exclusive design are such as will meet the

particular requirements of the intended work. In order to cover such cases it is quite usual in the provisions of city charters to find such terms as "lowest and best bidder," or as "lowest responsible bidder," and the like; and these phrases have been given by the courts a particular meaning, in which it must be presumed they are used by the framers of city charters in the absence of other limiting clauses. The term "lowest responsible bidder" has been held to mean the lowest bidder whose offer best responds in quality, fitness, and capacity to the particular requirements of the proposed work; and that where by the use of these terms the council has been invested with discretionary power as to which is the lowest responsible bidder, having regard to the quality and adaptability of the material or article to the particular requirements of its use, such discretion will not be interfered with by the courts in the absence of direct averments and proof of fraud. (2 Dillon on Municipal Corporations, 5th ed., Sec. 811, p. 1223, and cases cited.) And even when in statutes and charters the term "lowest bidder" only is employed, the courts have held that in determining whether a bid is the lowest among several others, there may be cases where the quality and ability of the thing offered--in other words, its adaptability to the purpose for which it is required--may be considered.' "

It was further held that:

> "The rule in this state is that it is not necessary for a city council awarding a bid to other than the lowest bidder to make a specific finding or record to the effect that the lowest bidder was not the lowest responsible bidder, and that to attack the award, the attacker must allege and prove fraud."

In the instant case the defendant board of education was not required to make a specific finding that plaintiff was not the lowest responsible bidder and its award of the contract cannot be here attacked since fraud was not alleged or proved. Even if we assume that it was necessary that the board make a finding that plaintiff was not the lowest responsible bidder, the evidence introduced was sufficient to support the finding made by the board and the trial court so found.

Any purchase of furniture or similar items which is not made in compliance with the competitive bidding requirements of the Education Code is void. Possible consequences are that the seller will not be paid for furniture which has been delivered. If, on the other hand, an illegal payment has been made to a vendor of furniture, it is possible that a personal liability on the part of members of the governing board can be asserted.

It is highly desirable that legal problems as they arise be referred to the District Attorney or County Counsel.

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part 2

improving the school environment
through

EDUCATIONAL PLANNING

San Francisco Examiner

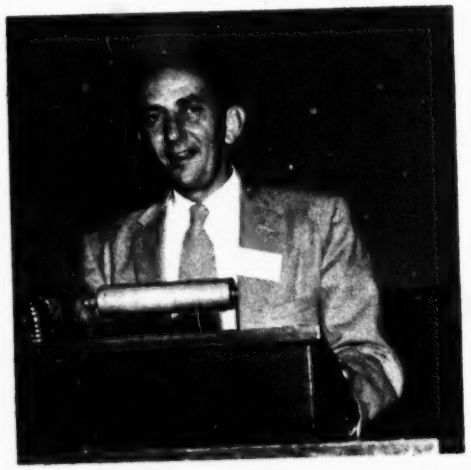
Scenes From The School Planning Laboratory

LAND USE

MAPS PREPARED BY GRADUATE ASSISTANTS REVEAL SIGNIFICANT DATA REGARDING POPULATION SATURATION OF AN AREA. HERE DR. RAYMOND C. SCHNEIDER, WHO IS ALSO AN ARCHITECT, DISCUSSES A POINT WITH OWEN TENDICK, A GRADUATE STUDENT IN SCHOOL PLANNING.

No. 2

DEVELOPING THE EDUCATIONAL SPECIFICATIONS



JON S. PETERS, Educational Consultant,
Stanford University

The primary reason for developing educational specifications is to aid in the translation of the educational program and its space requirements into actual physical facilities. However, in order best to plan for and provide the facilities required to meet the educational needs of a community it is essential to develop a long-range master plan, built on the foundation of a careful and exhaustive community analysis.

Such an analysis should take into consideration factors like: the historical development and present ecology of the community, climatic conditions, the labor market, employment, wage scales, the occupational range, population development, the present age distribution of the population, family size and composition, saturation potential, land use, zoning practice and trends, availability of additional land, possible re-development, tax rates and trends, present transportation, potential transportation, electricity, gas, water, sewers, fire and police protection, manufacturing practice and potential, extent of and proximity to markets, general community progressiveness, the extent and importance of churches, cultural and recreational facilities, the present public and private educational systems, government, hospitals, transient and resident housing availability and cost range, the communications facilities, mobility of the population, the apparent power structure, the paths followed by recent graduates, and the occupational opportunities for youth.

One of the most important questions to be answered is, "How many youngsters of what ages are there and will there probably be in the various residential areas of the community?" Population studies and projections must be made carefully and revised periodically. Highway re-alignments, easing of credit, release of land to sub-division, development of new

industry, or any of many other factors can change a population projection time-table rapidly.

Cooperative planning of the total educational program is desirable. There should be wide community participation in the development of the concept of the kind of school system desired -- in the determination of the educational policy of the community. What should be the grade organization -- 8-4, 6-3-3, 6-2-4? What should be the lower age limits -- kindergarten, nursery school, first grade? What should be the upper limits -- 12th grade, 14th grade? What should be the extent of adult education? What is a desirable sized school at each of the organizational levels? What is a reasonable walking distance for different aged youngsters? What is the place of the school district in the community recreational program? What community use can be made of school facilities? These, and many other questions, must be answered. Many communities, through lack of any clear-cut policy, have vacillated through all possible approaches to these matters.

The educational needs of the community, within the framework of the requirements of education in a democracy and in harmony with the expectations of the community, will determine the educational program for which physical facilities will have to be provided. Although there is a common saying among planners that the building is planned from within--i.e., that the educational program is basic to building planning--there is little doubt that careful and complete planning results in program improvement.

Although the educational specifications are concerned with the educational program, it is essential that due consideration be given to the financial limitations of the district. An analysis should be made of past revenues, and a projection made of anticipated assessed valuations and probable future revenues. There is little point in 'master planning' beyond reasonable support-capacity. However, all necessary compromises should be made on the basis of the educational program and in accord with long-range economies and maximum benefit from expenditures; design should be for appropriate and efficient educational use.

The actual format used in the development and presentation of the educational specifications is of relatively little importance as long as all of the pertinent information is presented in readily usable form. A twelve point coverage, as developed and applied by the staff of the School Planning Laboratory, School of Education, Stanford University, has proved acceptable to architects and district personnel alike.

The heart of educational specifications development is a complete and careful definition of the educational program. The only way that this can be accomplished for a given situation is through wide involvement of the people who are actively working with the program--the teachers and the central office staff. Consequently, efficient techniques of group participation are applied over a broad resource base.

Actual procedures for the development of the educational specifications include joint meetings with the consultants, the teachers, the central staff, the architect, and additional resource specialists. Ordinarily an orientation meeting will be held to define the problem generally and to consider the adopted educational policies, population projections, and other background materials. Specific grade-level and departmental meetings will be held to consider the unique requirements of these departments, as well as individual conferences with teachers. The preliminary specifications will be presented, considered, and revised with the various departments, as well as with a general committee.

In addition to district personnel, there will be

broad involvement of many other general and specialized resource people from the consultative staff, from the State Department of Education, from county offices, from college and university staffs, and from other school districts.

During the developmental stages, the architect will provide sketches, reflecting his tentative solutions of the educational problems, to the rest of the planners. By the time that the educational specifications are completed and approved there will have been sufficient interchange of ideas that the actual preliminary drawings will require a minimum adjustment.

In final form, the educational specifications will cover all of the aspects of the educational program which are essential to the planning and development of the physical facilities. The following points should be included:

Educational Outcomes

The general educational philosophy which will guide the entire educational program of the district must be defined. However, in the planning of a single school or an individual department or grade level of that school it is essential to be quite specific, within the total district concept. Consideration must be given to the developmental level of the youngsters involved, to the unique needs of the community, and to the specific area in question. The aims and objectives of the language arts curricula would differ from those of the industrial arts, even within the same school, while aims and objectives for different age-levels in different experience areas in different communities would bear little specific relationship to each other, even though they were all based on the same maximum-individual-development-within-society concept.

Trends

Discernable trends in both content and method, as they apply to these specific grade level or departmental offerings, are discussed and probed extensively. It is often desirable and necessary to bring in specific specialists to participate in the considerations. For example, in planning science facilities a science specialist, who is cognizant of trends and implications of science instruction, will discuss the present program in light of changes that may be expected, and in terms of space requirements.

A weakness inherent in broad staff participation in planning is that all staff members will not be aware of either the best current practice or the indicated trends in their area. Planners have a distinct responsibility to plan facilities that will not cripple the educational program. Consequently, there must be a competent and critical evaluation of staff contribution.

Activities

One of the most important, if not the most important, factors upon which space requirements are based is the complete description of what goes on in the classroom. A detailed and specific description is developed. If the entire activity consists of 30 students at fixed desks for 55 minutes at a time listening to a teacher's lecture, the space requirements are modest. If, on the other hand, learning activities take place through reading, displaying, discussing, experimenting, conferring, visualizing, listening, creating, and other related school activities the space requirements are different.

All too often, the kind and amount of space which has been provided bears little realistic relationship to the desired educational program.

Orientation and Relationship

One of the first things to be developed in the planning of any school is the general relationship which must exist among the component parts. Likewise, in developing the educational specifications for a single area, it is essential that relationships be designated. For example, a kindergarten may be considered as a separate entity--self-contained as to toilets, lavatories, and playground facilities--but still a part of the total elementary school. Or, with an indoor-outdoor program, it may be necessary to provide ready access to a warm, sunny area.

The total maintenance and operations program of the school, supply and service access, student and adult traffic, etc., all enter into consideration of this point.

Internal Traffic

There must be ample space for the instructor and the students to move from work stations to storage areas to instructional surfaces, etc. Amounts and time involvements of all internal traffic should be specified.

The total internal traffic of the school must be considered carefully so that lockers, toilet and lavatory facilities, corridors, entry-ways, etc., can be planned realistically to be able to handle expected traffic loads. It is not at all uncommon to find a school which functions reasonably well while the students are in class but which is totally inefficient during peak traffic situations.

Furniture and Equipment

The furniture and equipment is directly related to the expected outcomes and to the teaching methods (points 1 and 3). Although there is little point in designating furniture and equipment by trade name, it is essential to specify kinds, sizes, and amounts required to carry on the educational program.

Utilities

Any special requirements, essential to the educational program, are spelled out in detail. For example, color coding of primary classroom doors is often deemed desirable. Or, elementary school classrooms which are used for music instruction, may require additional acoustical treatment.

Specific heating, lighting, ventilating, etc., are architectural but it is presumed that efficient and pleasant learning laboratories will be provided.

Color, Decoration, and Acoustics

Any utilities which are required for the educational program are listed and justified. For example, if primary rooms are to be self-contained they will require toilet and lavatory facilities, a cleaning-up sink, and a drinking fountain as well as electrical outlets and conduit for television, radio, and inter-communications systems.

Storage

The one point in common with nearly all teachers is that they desire sufficient storage space for the various instructional supplies and equipment. However, unless storage spaces are planned carefully and specifically for the materials to be used they will not necessarily be either adequate or efficient. Often, teacher planned classrooms will contain excessive and

unused cabinet work, or the storage will not be planned specifically for the materials to be stored. Two recent cases come to mind. In the first, 24" wide paper storage space had been provided throughout an elementary school, while the district consistently purchased large quantities of 26" wide paper.

In the other situation, some 200 music storage drawers of expensive hardwood had been supplied. Unfortunately, the drawers were 1/2" narrower than the standard choral music they were intended to store-- however, by knocking one side out of each of the drawers, they do serve. In either of these cases, all that was required was for someone to hand the architect a sample or the dimensions of the materials to be stored.

The district purchasing and/or warehousing policy will determine storage requirements for individual schools and classrooms. A maximum list of supplies and equipment to be stored must be developed and equated into required storage space.

Special Requirements

Any activity which has special requirements beyong what is considered "normal" must be specified. For example, if art students work with oils in the classrooms, then both the work station table tops and the floor covering must be of a material which will not be harmed by such material.

Enrollments

Present and anticipated future class loads must be determined and listed. The developing teacher shortage coupled with the possible trend toward larger classes and supplemental help for master teachers suggest that classrooms will have to be larger.

Gross Space

Gross space requirements are determined from the actual educational program, the materials to be stored, and the anticipated class loads.

Educational specifications, following these twelve points, are developed for each of the kinds of spaces within the school, and are integrated together into a unified whole.

Although development of educational specifications as here outlined is time-consuming, it actually represents "real" economy and efficiency since the resultant physical facilities are a true reflection of the educational program.

Announcement

THE FOLLOWING PRESENTATIONS WERE MADE BY SCHOOL OF EDUCATION FACULTY AND STAFF MEMBERS, ALL SPECIALISTS IN THEIR RESPECTIVE AREAS.
SOME ARE AUTHORS OF RECENTLY PUBLISHED MONOGRAPHS ON THE PLANNING OF SPECIAL FACILITIES. ADDITIONAL MONOGRAPHS ARE IN PROGRESS AND WILL BE READY SOON.
WATCH FOR FUTURE ANNOUNCEMENTS FROM THE SCHOOL PLANNING LABORATORY OR WRITE FOR INFORMATION.

PLANNING SCIENCE FACILITIES

PAUL DeH. HURD, Associate Professor of Education, Stanford University

The planning of science facilities is a particularly difficult problem at the present time. Enrollments are decreasing in the specialized sciences. Yet, at the same time the greatest drive ever experienced in American educational history is under way to reverse this trend.

Planning science facilities on the basis of past or present enrollments is no longer realistic in the science areas. It seems certain that the combined efforts of the public press decrying the shortage of scientists and engineers; the positive interest of business and industry to increase science enrollments; and the professional training programs established by scientific societies, institutes, associations, and foundations will increase the demand for science facilities, whereas, present enrollment trends would belie this demand.

It would seem that the planning of science facilities in the midst of an evolving curriculum and an unstable enrollment pattern presents a demand for a firmer planning basis. The one clear point of departure is from the objectives of science teaching.

An especially important objective of science teaching is the development of the ability to carry on problem-solving activities and the disposition to do so in appropriate situations.

The most practical and realistic approach for developing problem-solving skills is to have students spend a great deal of time working on significant problems. This requires science facilities, planned in terms of problem-solving, which promote the learning and teaching activities associated with the finding-

Science facilities for problem-solving should make it possible for students to work together.

out aspects of learning. The science classroom environment should be conceived in terms of the functions, space relations, and facilities essential for the development of problem-solving abilities. Planning of

Problem-solving activities require a variety of resource mate-

facilities is not simply a matter of making sketches and choosing equipment, but is a procedure that begins with an analysis and an evaluation of the existing science curriculum in terms of its educational services. Goals are defined, learning and teaching techniques identified, then facilities developed to insure their realization.

Teaching-learning activities involved in this process include investigating, exploring, planning, validating, recording, trying-out, making judgments, appraising, organizing, correlating, evaluating, interpreting, observing, demonstrating, and experimenting. Good science facilities must provide for a wealth of these discovery-type activities.

This type of learning needs a rich and supportive environment, one that develops a climate of research. Learning science means studying problems, not chapters; investigating, not memorizing; and interpreting knowledge, not repeating ready-made answers. Teaching of this kind requires a room of great flexibility, housing a variety of learning resources such as, reference books, current periodicals, models, charts, and specimens; equipment and supplies for experiments; recorders, and projectors essential to the use of data contained on tapes, films, and filmstrips; materials for the development of projects and visual displays; and tools for making special equipment.

Scientists engage in many intellectual and practical activities associated with "finding out," and we expect students to have similar experiences at some meaningful level. Among other things, this includes working in a classroom where opportunities are provided for students to work on their own and to obtain some knowledge firsthand.

The instructional emphasis upon discovery activities requires that students have available to use at any time throughout the class period the various resources needed to provide essential data. Therefore, the physical facilities must make it possible to shift from one learning activity to another quickly and efficiently. Since class and laboratory are interwoven in terms of data seeking, it seems apparent these facilities should be combined into a single room.

Variations among students must be reflected not only in classroom procedures but also in the physical nature of the classroom itself. Facilities are needed which will make it possible for students to work as individuals or in small groups. Since problem-solving is a student endeavor, classrooms should be planned around student learning activities rather than teacher

functions. The students are the performers and therefore it is their activities that need to be accommodated. Classroom space is planned as a series of resource areas, identified with some special learning activity. For example, there are areas for demonstration, for projecting materials, for reading, for displaying, for developing projects, and for experimenting.

The gifted science students need an area suitable for a program of junior research. This suggests a separate room where special equipment can be stored, experiments can be left set-up, and students of similar interests and ability can work together in stimulating surroundings.

The rapid learner in science needs a place where he can carry on a program of junior research.

An outstanding science room provides for the acceleration of learning through a variety of sensory experiences. Facilities useful for this purpose include models, mock-ups, specimens, collections, charts, maps, pictures, cut-a-ways, and many kinds of laboratory equipment. In addition, students need facilities which will make it possible for them to organize and to present their ideas in a visual way, such as, chalkboards, tackboards, bulletin boards, display cases, project tables, and exhibit materials.

The development of problem-solving skills is the primary objective for the teaching of any science in the high school. Facilities suitable for the realization of this objective provide the gross requirements for the teaching of any high school science.

PLANNING GUIDANCE FACILITIES

HENRY B. McDANIEL, *Professor of Education and Psychology, Stanford University*

Routine dramas which occur frequently in schools include such things as:

"I hate my father"

"I can't dress right"

"I have to quit school"

"That teacher hates me"

"What room today?"

"We need to get ten transfer students started this morning"

"Let's call a case conference"

"Can your teachers provide me with background materials?"

"What about Cal Poly?"

"My son simply must make Stanford"

These imply many different kinds of functions and services, for which housing is required. There are distributive functions, which channel students; there are adjustive functions, which provide service or aid for immediate problems; there are adaptive functions through which there is an adaptation of the educational program to the perceived needs of students. There is an appraisal program, in which there is observation and recording of individual student growth and development; there is an informational program; there is a counseling service, built on a one-to-one relationship; there is placement activity, concerned with both educational and job placement; there are group activities on a non-course type.

Functions	Services
Distributive	Appraisal
Adjustive	Information
Adaptive	Counseling
	Placement
	Group work

Enclosures are required for:

1. Students who arrive early--a waiting room in which there can be relaxation (psychological cooling-off) and information (perceptual set).
2. Counseling offices, which present an atmosphere of confidence (quiet and uncluttered), and which are readily accessible to the rest of the school for conferring.
3. Group rooms, for such activities as student council, pick-up testing, and meetings.

Suggested Criteria

1. Counseling offices should be convenient to general offices.
2. Counseling offices should be near the offices of the Principal, Vice-principals, Deans, Health Center, and Attendance Officer, but not adjacent to those in control of discipline.
3. The administrative suite should have a central location on the first floor.
4. The library should be near the counseling room to avoid duplication of many materials.
5. The waiting room should open into a main corridor in order to be easily accessible.
6. The size of the waiting room should not be less than 150 square feet for a three-counselor system, and an additional 50 square feet should be allowed for each additional counselor.
7. The secretary in charge of the waiting room will need a desk and a typing table near the entrance.
8. Furnishings in the waiting room should include:
   a. a reading table
   b. chairs--not of the straight-backed variety

c. rugs, drapes, and floor covering different from that used in the rest of the school
d. a wall rack for college and occupational pamphlets; suitable materials would be substituted in an elementary school
e. a bulletin board

9. Color, with life to it, can be used in any soft shade.

10. Several individual conference offices must be provided where conferences of a more intimate nature on confidential matters can be held.

a. one for each 400 students
b. each room should be 120-150 square feet in size, in which case they could replace the conference room
c. they must have adequate lighting in order to use them for individual testing
d. each can be a different color scheme as long as the colors are attractive, fairly soft, and have life
e. each should contain a table and three informal chairs, a colored chalkboard, tackboard space, rugs, or equivalent floor covering
f. each room must have sound proofing, and a clear glass inset in the door about five feet above floor level

11. Group testing and conference room.

a. large enough to hold 16-20
b. contain a chalkboard at eye level on a central section of the wall, in a color to harmonize with the colors used in the room
c. rugs, draperies, and pictures should be provided
d. it should be soundproof, and could double as a small visual aids room
e. it should be adjacent to the counselors' offices.

Conclusions

Guidance services are facilitative staff services. Modern educational objectives perceive the growth of the whole child, and provide the warmth, challenge, and recognition needed for both affective and cognitive achievement of self-realization.

The builder of the modern school plant makes common cause with the parent, the educator, the physician, the psychologist, and the counselor in making these enclosures--these physical spaces--not to contain but rather to expand the life space of ourselves and our children.

PLANNING ART FACILITIES

Trends in contemporary art education manifest

the concepts of flexibility and diversification in planning facilities to meet the art needs and interests of pre-adolescents and adolescents.

The concept of flexibility in the use of structural materials considers space divisions in terms of fluidity, versatility, convertibility, and expansibility. These dimensions are reflected in terms of flexible space-use relationships; functional teaching-working surfaces; functional furniture and movable interiors.

The concept of diversification is based on the fact that there is increasing emphasis on art in the curriculum of secondary schools; and, concomitant with this growing value of art is the philosophy that art facilities should be made available to as many students as feasible--regardless of their level of art abilities. The "material approach" suggests the awareness of individual differences of students in art abilities, and stresses a wide range of art materials as one device for motivating students in creative problem-solving activities.

The following suggestions may be used as guideposts in planning the general art room or the crafts room:

Location

The art room or rooms should be: (1) on the first floor in a separate wing, (2) in the home arts, industrial arts, and dramatic arts zone, (3) near a parking zone for accessibility of evening classes, and (4) adjacent to each other, with storage rooms between them.

Size

The art room should be: (1) planned for a range of 45 to 55 square feet per student, exclusive of storage, and (2) planned for a room proportion of two to three ratio, or nearly square, to improve supervision and interaction of working areas.

Dr. Rose Dreiman outlines his concepts of flexibility and diversification in the planning of art facilities.

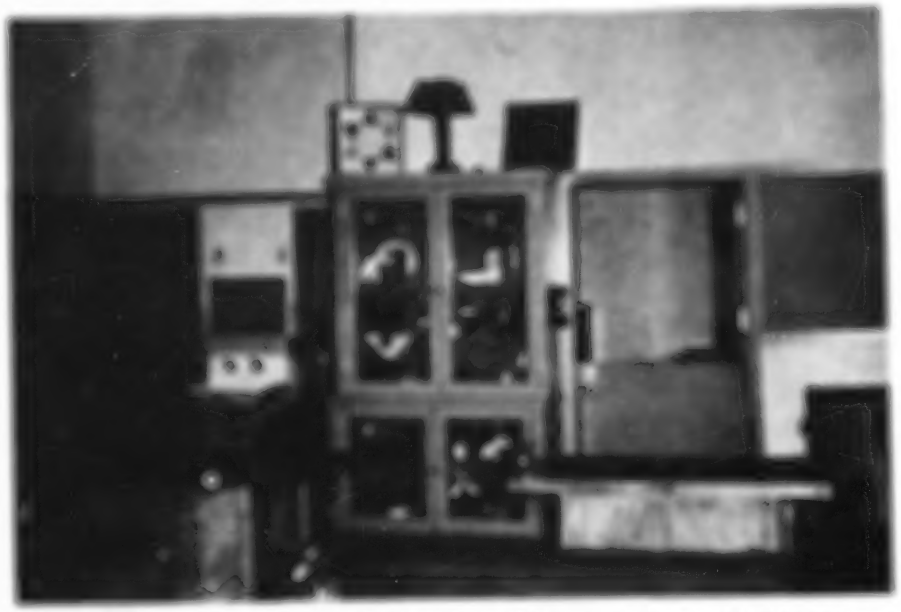
Supervision

The furniture, equipment, and space dividers should be arranged to give maximum visibility for the teacher. The auxiliary rooms should have vision strips or glazed partitions whenever it is feasible.

Color

Light neutral colors have usually been suggested for walls as a foil for the multi-colored displays.

There is a trend, however, toward the use of brighter colors as accents on doors, columns, furniture and open utility pipes. The art room should be the most exciting and colorful room in the school. Caution should be used in the selection of color harmonies and contrasts, and the lighting and color-conditioning engineers should work in close relationship in developing the light and color configuration necessary for visual comfort, and an esthetic environment.



Art storage spaces must be designed for a variety of objects.

Lighting

The lighting should have uniform diffusion and be free from glare and shadows--preferably with seventy-five to one hundred foot candles of illumination.

Acoustical Treatment

There should be adequate sound-absorption material on the ceiling or walls to reduce the noise of certain craft activities or normal conversation during classes.

Heating and Ventilating

There should be a mechanical heating and ventilating unit capable of maintaining standard conditions of heat, fresh air, humidity, and air movement in all weather conditions. Suitable ventilation facilities should be planned for removal of odors, fumes, and excess heat. The art room and related rooms should be on a separate circuit for evening classes which do not require the use of the whole building.

Utilities

The utilities should (1) be grouped together for economical reasons as well as for easy accessibility for possible future needs, and (2) have adequate and carefully planned electrical outlets to accommodate the necessary equipment.

There should be at least three or more gas and air outlets placed approximately thirty inches apart.

The sinks should be either the peninsula or island type to allow easy access from three sides. They should be acid-resistant; have integral drain boards; and contain a soap and paper towel dispenser, a sediment trap, a removal waste disposal receptacle, and a mixing nozzle for hot and cold water.

Floor

The floors should be of a type that will deaden sound, lessen shock, and resist dirt and stain. They should be easy to wash, and be able to withstand hard usage.

Doors

There should be at least one set of double doors to permit passage of large displays, murals, equipment, and furniture.

Audio-Visual

The chalkboard should be an "eye-rest" green color for "sustained seeing", with a possible reversible side of mat white so that black chalk may be used for drawing demonstrations.

All feasible wall spaces not covered by cabinets and equipment should be covered with pinboard or perforated board for working and display spaces.

There should be plans for at least one corridor display case near the art room entrance and two display cases within the room. All cases should have locks, adjustable shelves, and adequate lighting.

There should be partial or complete room-darkening facilities.

Space should be provided for a library corner that includes tables, chairs, magazine and book cases, files, and adequate storage space for films, film strips, prints, photographs, and other resource materials.

Furniture

Furniture should be of sturdy construction, be movable, and have washable tops. Finishes should be non-glossy, but be durable and easily maintained.

The woodworking bench should have four vises and a hardwood top, at least two inches thick.

Chairs and stools should either be adjustable or be of different heights to accommodate the various body heights.

There should be sufficient work stations at tables, benches, or work counters for all students in each period.

Storage

Damp storage cabinets should have non-rust shelves, be air-tight, and have at the base provisions for water storage. Drying cabinets should have non-rust, perforated shelves; be well-ventilated; and, if possible, contain infra-red lamps. Clay carts should be lined with non-rust metal.

Dr. Jon Peters demonstrates effectiveness of black chalk on a white chalk board which could be used for freehand drawing instruction. (photo by Stanford)

Folding type easels and art horses should be planned for economy of storage.

There should be a cabinet for each class period. These cabinets should be designed to hold enough drawing boards and tote trays for each class. There should be space planned at the top of the cabinets for unfinished and finished work.

A typical small tool storage cabinet

There should be a tool case, a tool cabinet, or sufficient portable panels to accommodate the necessary tools for each activity.

Shelves should be adjustable whenever feasible, and should be of different widths to accommodate specific materials. The inside dimensions of shelves and drawers should be at least an inch laarger than the materials to be stored. This helps elirminate damage to the materials.

All paper and cardboard should be stored horizontally, with the exception of paperr rolls four feet and over in width. A 36" paper roll dispenser should be placed under a work counter.

Safety

A fire extinguisher and a firstt-aid cabinet should be placed in the crafts area.

The work counter and the backkboard in the soldering and annealing area should have fire-resistant surfaces.

Hanging Facilities

There should be metal rods with turn-buckles attached placed in the two walls on the long axis of the room. These rods will be used to string wire that will hold mobiles or other three-dimensional objects. These wires should be placed approximately eight feet from the floor.

Warning Bell

An automatic warning bell, preferably connected with a regular electric and clock system, should be installed to aid in the clean-up procedures.

Equipment

A typical work center showing the kiln.

A multi-purpose room designed for such activities as drawing and painting, metal, wood, leather, plastic, weaving, block and screen printing, ceramics and photography should include the following items:

A view of special area for pottery making.

(1) an electric ceramic kiln with a firing chamber at least 14" x 14" x 14", top-loading kiln preferred (if adult classes are planned, the firing chamber should be at least 18" x 18" x 21"); (2) an electric enamel kiln with a firing chamber at least 8-1/2" x 9" x 5-1/2"; (3) an electric potter's wheel; (4) a power scroll, band or jig saw; (5) a sander, buffer, or grinder; (6) a spray booth with exhaust fan; (7) a portable drying rack; (8) three or four table looms; (9) a proof press; (10) an enlarger and contact printer; (11) a paper cutter at least 18" x 24"; and (12) a wedging board.

ROSS C. DENISTON, Consultant, Art Education, School Planning Laboratory

PLANNING PHYSICAL EDUCATION FACILITIES

Location of the Gymnasium

Two major considerations in locating the gymnasium are accessibility and isolation. Accessibility requires the gymnasium to be readily available to appropriate school facilities and to those groups who will be using the gymnasium.

The noise associated with gymnasium activities makes it desirable to isolate the gymnasium from certain other school facilities. Libraries, study halls and classrooms which need quiet surroundings bear considerations in relationship with gymnasia.

Activity Facilities

The activity facilities are the physical education classrooms. As such, they should appropriately accommodate instruction and participation in the activities to be conducted for the number of students scheduled in a physical education class. Inclement weather should not inhibit the instructional physical education program. Therefore sufficient teaching stations should be pro-

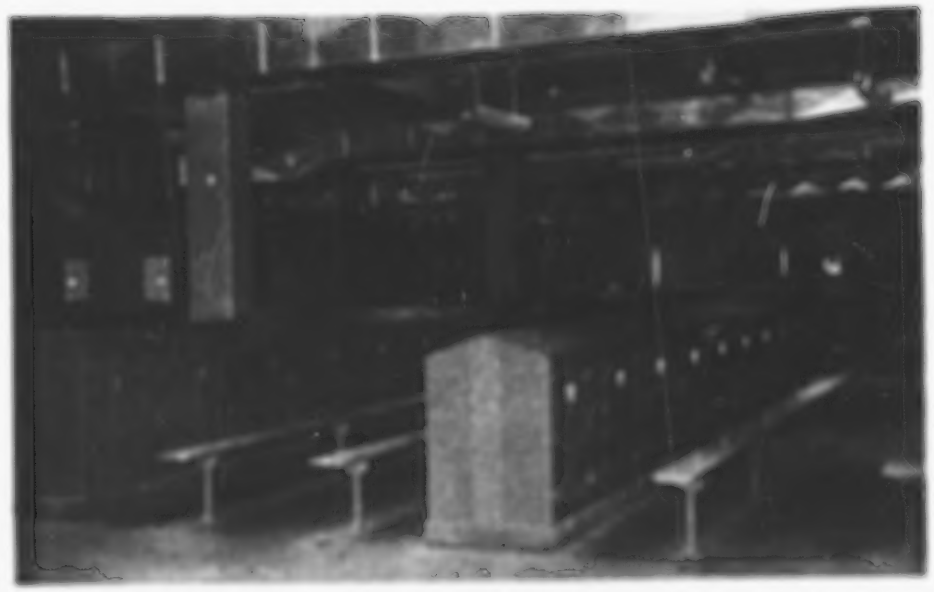
vided to conduct the instructional physical education program indoors. A teaching station is an area large enough to allow each teacher to teach his entire class at one time.

Auxiliary activity rooms in addition to the main gymnasium area are being constructed in high school gymnasia because of a broader activity curriculum and the concept of teaching stations. The factor of utility has resulted in these rooms being constructed to house varied activities. Care must be taken in constructing auxiliary rooms to not limit the activities conducted therein by inappropriate dimensions. Floor space should be provided in accordance with the activities housed and the number of students to be accommodated. Ceiling heights appropriate to the activities must not be overlooked.

Multi-use of an auxiliary room creates a need for storage areas in or adjacent to the room. Particular attention must be given to providing storage space for gymnastics apparatus in a multi-use room. It is recommended that recessed storage space be provided for wrestling mats.

Auxiliary rooms should be equipped with chalkboards and tackboards for instructional purposes. These classroom aids should have no sharp corners or edges which might result in injury to a participant in an activity. The boards should be in a location which will not interfere with activities conducted in the room.

The main gymnasium area should have appropriate floor space to accommodate the activities it is intended to house for the number of students to be taught. A height of 24' is recommended to accommodate such activities as basketball, volleyball and badminton. It is recommended that spectator seating be provided by telescopic bleachers. This provides maximum utility of the facility which would be limited if permanent



Lockers should be low for unimpaired vision of the entire locker room.

bleachers were installed. Balconies should also be equipped with telescopic bleachers so they may be used for physical education activities as well as seating.

Heating and ventilation should be provided for by a mechanical automatically controlled system in all activity areas. It has been recommended that the temperature in activity areas be between 60-65 degrees. However, in the case of spectator sports, this temperature may prove too cold for spectators. Unit ventilation should therefore be provided in an attempt to keep participants sufficiently cool and the spectators sufficiently warm. If the gymnasium is used for such activities as assemblies or commencements, the ventilation system should not inhibit the presentation of speeches.

Natural lighting should be provided by windows and top lighting but should not result in a glare. The windows should be above fourteen feet if walls will be

used for one-wall handball. The height of the bleachers and location of backboards will affect window height. Artifical light should be above the 24' ceiling clearance recommended and should be protected by wire screens. A light intensity between 15-25 footcandles at a height of 4' has been recommended. A method of servicing the lights should be provided in the main gymnasium.

Acoustical materials should be used on upper walls and ceilings of all activity areas. Acoustical material should be used above a 7' cushioned or paneled wainscot in the auxiliary rooms and in the gymnasium area if bleachers are not installed against the wall.

Service Facilities

Appropriate dressing, showering and toweling facilities and space should be provided participants in physical education.

Traffic circulation should provide a pattern from locker room to shower room past towel issue room.

Lockers should be installed on a covered concrete base 8" high to facilitate maintenance and ventilation. Lockers installed back to back should have a 4" ventilation space in between them. Fronts of lockers should be louvred and the backs should have as many perforations as possible without weakening the locker. The height of the installed lockers should be approximately 5' except when they are against a wall. This arrangement allows a vision strip over the top of the lockers. A 12" bench 16" high should be provided for the convenience of students while dressing. Appropriate space approximately 8' should be provided between rows of lockers to facilitate traffic circulation. Hose bibs and floor drains should be provided to facilitate maintenance.

Showers should be installed to a height of 5' with an angled spray. A non-clogging stationary type shower head should be used. A distance of 3-1/2' should be provided between shower heads. A gravity type liquid soap dispenser should be provided between showers. A distance of 8' should be provided between rows of showers in which shower heads face one another. All exposed pipe should be either recessed or securely fastened to the wall.

A drying area approximately equal in size to the shower area should be provided. A towel issue room may be desired in or adjacent to this area.

Floors in the shower and drying area should drain toward gutters along the outside wall or to drains in pitched drainage basins. Non-slip material should be used.

Traffic circulation should provide a pattern from locker room to shower room past towel issue room to drying area and back to locker room.

A mechanical, automatically controlled heating and ventilating system should be provided to control the rapid accumulation of heat and moisture and fix-

tures should be provided throughout this area.

Acoustical material should be utilized throughout the locker and shower areas. The number of boys involved in these areas warrants acoustical consideration.

Natural light should be provided wherever possible. Top light and windows placed high in the walls may be used to provide this natural light.

Toilet facilities in appropriate quantity should be provided in a location readily accessible to the dressing and showering areas. Proper ventilation of a mechanical type is essential in these facilities.

Extensive use of the gymnasium for recreation by adult groups makes it desirable to section off part of these service facilities for use by these groups. This arrangement reduces the maintenance of the entire facility as a result of use by a small group.

Home and visiting team rooms are included in some gymnasia to provide dressing facilities for athletic teams. These rooms may also function as dressing facilities for recreation groups in lieu of the sectioning arrangement previously mentioned. They may also be used in conjunction with an outdoor swimming pool for summer recreation swimming programs. Provision of tackboards and chalkboards in these rooms is recommended to enhance their use as classrooms and meeting rooms. Lockers in these rooms should be sufficiently large to facilitate storage of personal athletic equipment. If practice clothing is not stored in an equipment drying room, appropriate ventilation of the lockers is a necessity.

Administrative Facilities

Staff dressing and showering facilities are frequently not appropriately provided. The trend in school athletics is toward more teams for more students in more sports. This means faculty personnel other than physical education teachers are involved in teaching these teams. Staff facilities should be provided to accommodate this additional personnel. Large dressing lockers and showers in appropriate numbers should be provided. Incorporated into this suite of staff facilities should be toilet facilities. Proper ventilation should be provided to isolate moisture and odors throughout this area.

The staff offices should be appropriate in size and accessible to the student service facilities and the indoor and outdoor activity areas. It has been recommended that the office be about 4" above the level of the adjacent service and activity facilities to facilitate supervision. It is not intended that the office become a watch tower. The raised floor is to allow the teacher to continue to contribute to supervision even when called to the phone. Desirable vision strips from the staff office are illustrated in Diagram IV.

Extensive use of glass and sliding glass panels enhances the vision and communication from the staff office whether the floor is raised or not.

Storage rooms should be appropriately placed throughout the gymnasium. Mention of storage areas for the auxiliary rooms was previously mentioned.

A general storage room should be provided in or near the main gymnasium area, especially if assemblies and other school functions are conducted therein. In such cases a portable public address system, risers, piano, folding chairs, walk mats, and other equipment may have to be stored.

A general physical education storage room should be provided where it is accessible to a service road and both indoor and outdoor activity areas. An equipment issue room should be provided and have similar considerations.

General considerations for storage rooms in-

clude the following:

1. No center mullion should be provided if large equipment will be stored in the room.

2. All doors should be sufficient size to accommodate the equipment and apparatus to be stored.

3. An even floor should be provided from the storeroom to activity areas so heavy apparatus may be rolled to and from the storage room.

Bill Arce talks to a conference group about planning physical education facilities.

4. A coved metal base should be used in the walls of all storage rooms and activity areas in which heavy apparatus will be used to protect against damage from the apparatus.

5. All storage areas including equipment drying and equipment issue rooms should be planned to appropriately accommodate the equipment they will store.

WILLIAM B. ARCE, Consultant, Physical Education, School Planning Laboratory

PLANNING SECONDARY SCHOOL CAFETERIAS

Cafeterias are an almost indispensable facility in secondary schools of any size today. Important learnings take place in the cafeteria in the realm of the social graces, in food and sanitation habits, and in economic practices.

The cafeteria should be adaptable for independent community use--by parent-teachers and similar organizations, by various school clubs and committees. Therefore, it should be readily accessible from the street and convenient to parking areas. As for orientation to the remainder of the school plant, it is an advantage to locate the cafeteria in close proximity to the auditorium and gymnasium since most community events will involve one or the other of these facilities plus the use of the cafeteria for refreshments. The "cafetorium"--combination of cafeteria and auditorium--provides multiple use of an expensive facility in a generally satisfactory manner.

Tastefully landscaped and attractively decorated,

the cafeteria can become a focal point for school and community activities.

The dining room of the cafeteria or cafetorium should be adequate in size to seat the present and projected enrollment in not more than two sittings. At the secondary school level, chairs are preferable to benches because of the awkwardness for girls of getting into and out of bench seats.

Multiple-use of the facility such as is shown here is to be encouraged, but the cafeteria-gymnasium combination should be avoided.

Table tops finished in formica or similar material make for easy cleaning and long wear. In cafetoriums the space under the stage is often used for storing tables and chairs.

The internal orientation of the cafeteria should be such that there is a well-marked traffic pattern from entrance to serving line to dining area to dish-return window to exit--without crossing traffic patterns.

The dining area should be planned so that it can be closed off from the kitchen and serving areas to minimize the disturbance from kitchen noises.

Asphalt tile makes a very satisfactory floor covering through the cafeteria unit.

The wall-enclosed, fold-down table is in fairly common use today. As stated earlier, the separate tables and chairs are considered preferable for high school age students.

If fold-down tables are used, the floor ends of the tables and benches should be protected with slides.

Analysis of cafeteria functions divides its activities into ten areas: meal planning, receiving, storing, preliminary preparation, preparation, serving, dining, dishwashing, garbage and trash disposal, and cleaning.

The cafeteria manager must have some kind of desk space for menu planning, keeping records, telephone, etc.

Larger schools should have a loading platform to which trucks can back up and discharge stores and supplies. From here they are routed to the storerooms -- dry stores and refrigerated stores. It is desirable that there be entrances to the storerooms directly from the loading platform or at least in such a location that deliveries do not have to be made through the main kitchen.

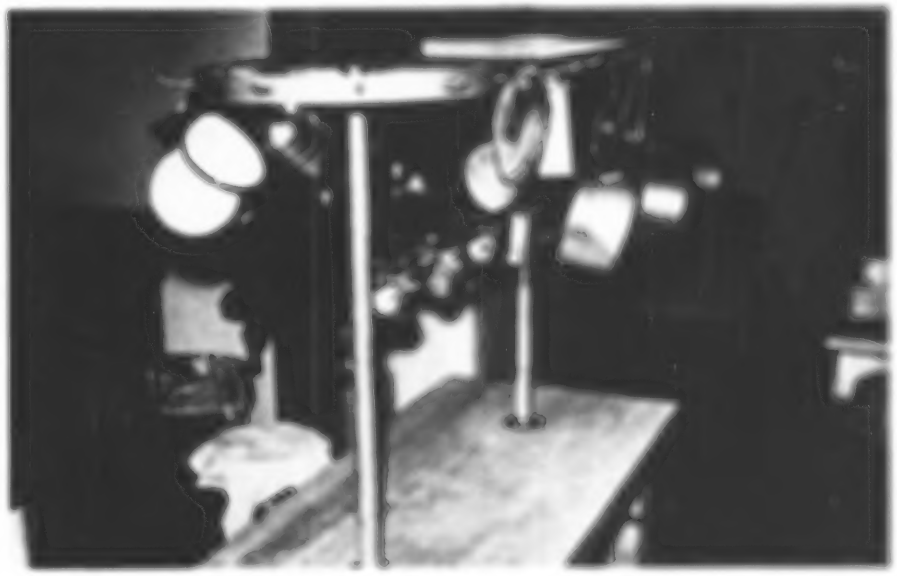
The dry storage room should have sufficient shelving to prevent stacking of materials on floor area.

The dry stores storeroom should have plenty of shelf room in order to avoid having to stack boxes in the alley ways. If practicable, the use of two smaller storerooms is preferable to one large one because of the greater shelf room possible.

Shelving should be of appropriate size and spacing to accommodate the containers used. Neat and uniform stacking of tins makes for easy and quick inventory.

No compressors or other mechanical equipment should be located in the storeroom and an outside window for ventilation is most desirable. Storage space entrances should be visible from the main kitchen area for supervision and security purposes.

Use is made of galvanized cans for storage of beans, rice, etc. which are mounted on casters for easy movement.



Cooking utensils generally hang from a rack over the preparation table.

Preliminary preparation areas for vegetable, baking and meat preparation are necessary. Here again, internal orientation is important -- allowing a flow of materials in logical sequence of use with well-marked traffic patterns and avoidance, so far as is possible, of crossing paths.

The potato peeler is a virtual "must" in schools of any size. It should be mounted high enough to allow the peeled potatoes to roll down the tray and into the sink. Facilities for garbage disposal should be close at hand for the peelings.

All preliminary preparation areas should have their own sinks with hot and cold water mixing faucets and drains of adequate size for quick emptying.

The preparation area centers about the stoves and the cook's table. This area should be kept compact in order to save steps, but should not be cluttered.

Hot and cold water plumbed to the cook's range is very convenient and avoids the necessity of lifting heavy kettles in order to add water.

Electronic heat and grease filters installed in the hood above the range make for a cleaner and more comfortable kitchen. The separate filter panels may be quickly lifted out of their holders and rinsed in a detergent solution to remove accumulated grease.

Floors in the kitchen should be grease resistant and non-skid. Terrazzo or grease-proof asphalt tile are two good materials. Thick rubber matting with non-skid, interlocking sections solve the kitchen flooring problem for many schools.

Storage for the cook's utensils poses a problem solved usually by having the utensils hang from an overhead rack which forms a superstructure for the cook's table. Care must be exercised that enough headroom is allowed so that the utensils do not become a hazard for the cook's head! This danger can be avoided by planning the table wide enough that the pot-rack is well inboard of the table's edge.

The serving area ideally should be separated from the kitchen area and multiple lines provided in order to serve students rapidly. Research shows that it should take an average of only ten seconds per serving and long waits in the serving line discourage students from patronizing the school cafeteria.

The best material for the serving counters is stainless steel -- a material which requires practi-

cally no upkeep and avoids the unsightly stains from oxidized surfaces.

Most newer school cafeterias are using electrically heated wells instead of steam tables and find them quite satisfactory provided they are independently controlled with separate switches.

A handy arrangement is a "pass-thru" refrigerator between kitchen and serving areas so that desserts and salads can be stored as made up in the kitchen and removed as needed from the other or serving area side.

Besides the regular dining area, schools recognize the need for a separate faculty dining room. Current practice in faculty dining rooms is to provide an independent serving line for that area.

A prominent feature of the school cafeteria serving area at present is the student snack bar -- a serving area dispensing short orders (hamburgers, milk shakes, candy, etc.) to students who may be supplementing lunches brought from home or who may not wish the full type A hot lunch. Typically, the snack bar is student operated and opens through a serving window on an outside corridor.

Discussion of snack bar facilities with cafeteria managers brings out the fact that some such facilities are too "square" in dimensions. The most efficient arrangement appears to be one which allows only a narrow corridor between the serving counter and the supplies such as ice cream freezer, candy case, hamburger grill, bun warmer, etc.

Since California weather is conducive to lunching outside much of the school year, many secondary schools in that state provide for outdoor eating areas with tables and chairs under an awning or other shademakers and with appropriate wind breaks.

Unfortunately, clean-up time comes even in school cafeterias and dishwashing is one of the very important functions to provide for. Sanitary regulations call for very hot water and lots of it. From the dish-return window whence the dirty dishes are brought by students when finished eating, the dishes would flow in a logical way past the garbage disposal drops to the washing machine racks.

Student help operates the dishwashing machine at most schools and because of the noise involved, a separate room is recommended. Adequate drains in the floor providing for easy hosing down of the area is a desirable feature.

Dr. Ray Schneider and Dave Shupp show slides and pictures they gathered by Bill Hyman.

Since the dishwashing area involves the use of very hot water, a considerable amount of steam is produced which tends to raise the humidity to a point that may become quite uncomfortable to the workers. Therefore, the installation of a hood and exhaust fan above the dishwasher is very desirable. (Continued on page 110.)

part 3

improving the school environment through

PHYSICAL CONTROL

San Francisco Examiner

Scenes From The School Planning Laboratory

ARCHITECTS

ARE AMONG THOSE WHO VISIT THE SCHOOL PLANNING LABORATORY SEEKING HELP AND INFORMATION REGARDING NEW CONCEPTS IN THE EDUCATIONAL PROGRAM AND NEW PRODUCTS AVAILABLE FOR SCHOOL USE. L. F. RICHARDS, A.I.A., SANTA CLARA, CALIFORNIA AND PRESIDENT, PALO ALTO CHAPTER, AMERICAN INSTITUTE OF ARCHITECTS, WRITES WITH INTEREST AND APPROACH TO PLANNING THE CLASSROOM PRESENTED BY DAVID E. WILLIS, GRADUATE ASSISTANT, SCHOOL PLANNING LABORATORY.

No. 3

PHYSICAL FACTORS AFFECTING THE CLASSROOM ENVIRONMENT

DARELL B. HARMON, Educational Consultant, Austin, Texas

Changing educational trends and growing integration of school and community activities to provide for better learning are demanding highly functional and widely adaptable school structures. Many school buildings constructed today will be in use 20 to 30 years from now, even though educational programs may continue to change radically. Hence, in current school design the growing emphasis is on flexibility.

Among major design problems brought about by this emphasis is that of providing needed flexibility without at the same time destroying acceptable tolerances of the physical surround, beyond which the child can be twisted in his growth, development and learning.

The space and energy tolerances and controls with which I am concerned have application to design factors related to how children learn. Community needs, population changes, and constantly evolving curricular organizations determine the form schools will take, and the classroom environments to which the principles with which I am concerned will be applied.

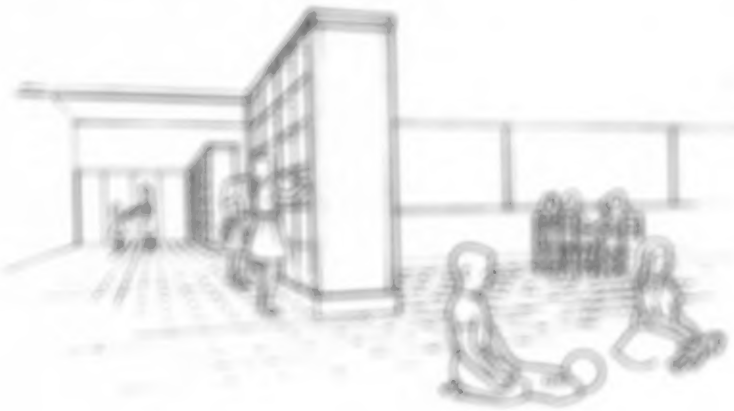
How children learn, and the principles of meeting their visual, auditory, thermal, and other physiologic needs related to learning, remain constant. Where children will learn changes with the changes in the world around them. School buildings cannot be rigidly typed or rigidly structured in a society such as ours even for the life of a single building.

Flexibility is not a new concept in school design. Some educators have been demanding it in some form in their school structures for years and some architects have long since been designing in that direction. But both demand and design have generally been limited in their concept; principally to increases in space within classrooms to permit the free movement of active children. This design change has been accompanied by designs of movable equipment which permit ready re-arrangement of rooms as activities change throughout the day. Flexibility in the past has been principally interpreted as movability within the classroom.

Economic necessity, public demand, and edu-

quate technical know-how have to combine at an opportune time to bring about major and general changes in education design whether those changes be in curricula or plant.

Advancing research in education and child development has brought increasing scientific insight into the nature of knowledge and the learning processes. Opportunity and demand are reflecting these advances in educational programs and school design. Enriched understanding of children and the nature of learning shows that knowledge is not something apart



from behavior, but is actually a function of behavior itself. Today's teaching stresses the USE aspects of learning. "a child learns by doing."

Increased knowledge of the nature of children and learning has brought with it carefully thought through changes in methods and materials of instruction in order to improve the quality of living and learning in our classrooms, and to implement the USE aspects of education. These changes have been accompanied by equally significant changes in classroom design. To facilitate the program of activities through which children experience what they find in books and other source materials, total space within modern classrooms is organized much differently than it was in the conventional rectangular rooms of a generation ago. No longer do we find rigid rows of identical desks and seats which filled most all the room, with little or no space left for applying what was gained from books, films, slides, tapes, and teacher discussions. Modern classrooms are characterized not only by movability. More and more classrooms are becoming self-contained organizations in which children using them find the space, equipment, and other facilities needed to carry on the program of learning experiences expected of them.

As stated, public demand, economic necessity, and adequate technical know-how have to combine at an opportune time to bring about a major change in educational design. Such a combination and timing is with us now in relation to flexibility. This combination is requiring three characteristics, in addition to movability, in school plant planning: expandability, alterability, and changeability.

Expandability: Population shifts, and population increases, leave us unable, at times, to predict room enrollments. To allow for this, room sizes should be changeable, and such changes should be simple to do, and economically feasible.

Alterability: Industrial and urban developments change age groupings of children. The nature of a school plant, too, should be easily alterable. Again, such changes should be simple to make and economically feasible.

Changeability: As new community resources develop, a new school should draw upon the concurrent changing resources for the child's learning experiences. It follows, then, that the new school draws unto itself changing activities to enrich those experiences. Not only is increased space needed, but re-arrangements of that space must be possible to preserve and promote flexibility.

However, movability, expandability, alterability, and changeability are characteristics of the form of the modern classroom. They have come into demand largely from the group definition of the tasks of learning.

One more "ability" must be added to our list of the characteristics if a classroom is to be complete. And that is usability defined from the viewpoint of the psycho-physical child.

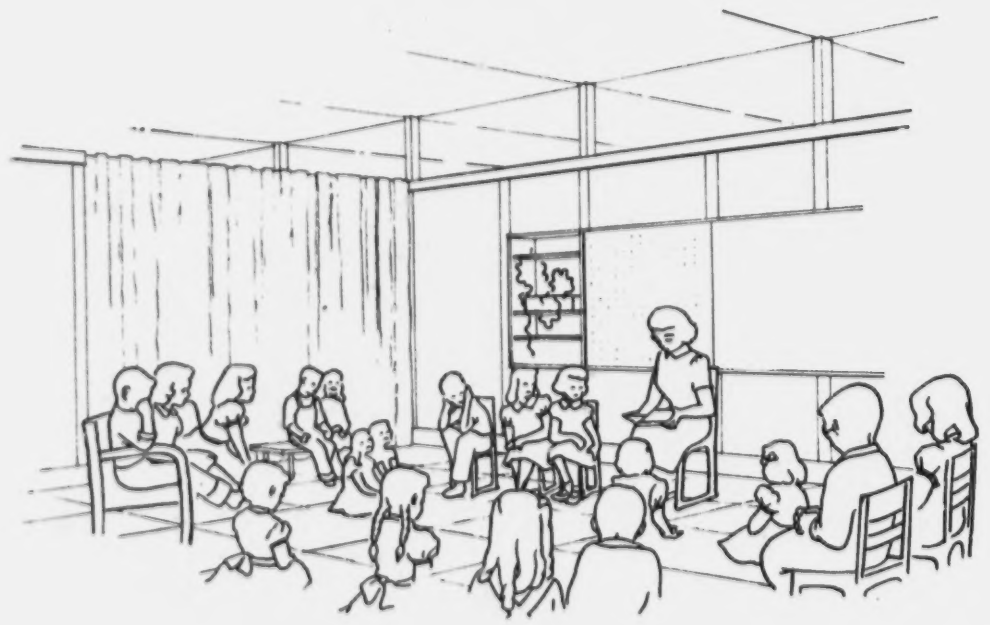
Classroom space must be designed not only from the social and materials aspect of learning but from the organic aspects of the performing child as well if the use functions in modern teaching are to be met.

Stimulation towards the use of things in the classroom world around the child is derived from the organizations of light, sound, heat, and other biologically significant energies which surround him.

In present practice, most design in the areas of light, sound, heat and equipment are based on a psychology or physiology which is a relic of the regimented, formal "passive absorption" days in education.

Sensory Psychology Too Restrictive

The limited psychology referred to uses clarity of image (especially that of symbols) and speed of recognition, together with subjective standards of relaxation and comfort as criteria for evaluating adequacy of design. In other words, design is judged by asking, in effect:

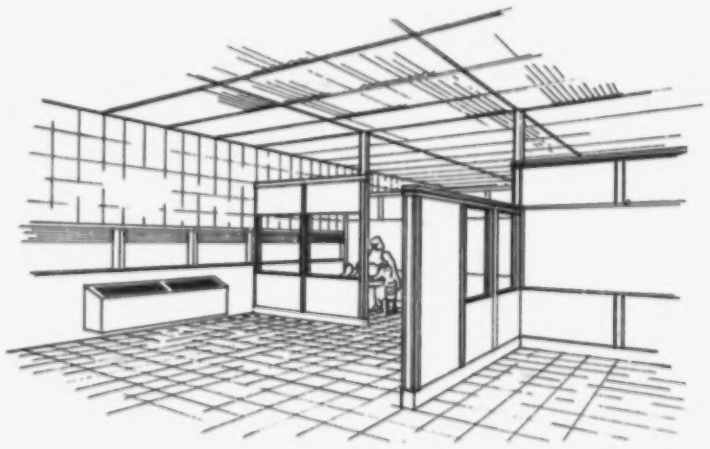


"How clearly can children SEE the type in their books or the writing on the chalkboard in this lighting?"

"How well do they HEAR the teacher in this room?"

"How comfortable do they say they FEEL with this heating and ventilating?"

This restricted approach to design is applied as if the detection of things outside the individual made for learning is limited to social recognition and communication.



Similarly this limited concept of learning implies that the acquisition of skills consists of tongue, lips and jaws or arms, hands and fingers practicing certain socially determined action patterns and, through exercise, conveying these to the brain as pattern imprints or road maps for directing later acceptable behavior. This easily leads to a design approach for equipment directed toward only the social and structural function of that equipment (i.e. grouping possibilities, novelty of appearance, movability, stackability and the like) as long as the child is relaxed and comfortable.

Some of this may sound exaggerated until we critically examine much of what is being done in our newer schools in lighting, equipment design, heating and ventilating and other areas of physical control with respect to all the implications contained in an informal activity curriculum.

Modern Purposes Contradicted

Research and design studies have vastly improved on old standards of lighting, heating, ventilating, equipment and sound control, but still under the influence of the restricted psychology of the formal school. But as these newer solutions are incorporated into more flexible and informal buildings intended for "learning-by-doing" curriculums, the actual result is to set up an environment more favorable to formal or "desk-and-book" programs contradicting the modern purposes of the curriculum for which the building was intended. Social stimulation to activity in an environment conducive to passivity leaves the learning child in a dilemma. Such solutions, consequently, have little to offer the flexible school.

We are prone to think of the human organism as highly adaptive when the contrary is true. When under continued high stresses in a working area the organism shifts stresses or resulting strains to reduced performance efficiency, to other areas of function, or to later times.

In the fields of light, heat, and sound, designers must reach their conclusions by considering the total organism and its ways of performing tasks. In these fields a simultaneous approach to design must be made which is based on an understanding of the total functioning of the organic child and HOW he performs in the learning task.

MEETING THE CHILD'S CLASSROOM NEEDS

Z.A. MARSH, Chairman, School Facilities Council

We all have children, friends or relatives who have yet to make their way through our school systems. We must recognize the importance of education and educational facilities in preparing these children as well as the other children that make up our nation and our nation's future leaders. If we do not plan to best meet the needs of the children in our school buildings, we will have less than we should have in the way of a teaching facility.

Certainly, there are numerous groups that are sincerely interested in building better schools and that are conscientiously trying to do something about it. But if you should go to one of their meetings, to an architects' convention for example, you would find that everyone there is an architect. There is not an educator in the crowd, and for all practical purposes, the architects are talking to themselves.

The same is true with other professions attempting to solve school building problems. Educators, engineers, businessmen, all honestly aiming at better school planning, all holding national conferences, all becoming vehement about the condition of our school buildings, all ending up talking to themselves. It doesn't do us any good to just ask, "Why don't they build the kind of schools we need?" It doesn't do us any good to just complain about it. We must find ways and means of working together, pooling our resources, to come up with the best possible school building.

You might say that with all the diverse groups that are involved, such as architects, engineers, businessmen, school superintendents, principals, teachers, and the various specialized groups such as audio-visual aids and physical education it would be impossible to ever get everyone thinking in the same direction and working together.

This is not at all impossible. When we have this sort of situation we look for a common denominator and in this case we have a very valid one--a better education for our children.

The recently established School Facilities Council is dedicated to this end. This Council was originally formed by a group of people with diverse professional

backgrounds who were sincerely interested in providing better communications between people involved in teaching and those who are planning school buildings. The thought being that most people involved in school construction and planning are basically honest and if the facts are presented sincerely they will be used in planning future schools.

The theme of the School Facilities Council is "The High Cost of Savings in Schools." The School Facilities Council has aided in the planning of conferences in the following states: South Carolina, Ohio, Minnesota, Indiana, Georgia, Florida, Iowa, Kansas, North Dakota, and California. Several other statewide conferences are being planned at this time.

The objectives of the School Facilities Council are:

1. To promote the best possible education for children, young people and adults through continuing improvement of school building design, school sites, school facilities and school equipment.

2. To promote wide and continuing interest, understanding and active support on the part of architects; business and industry; and education, professional and responsible lay educators for the betterment of school facilities.

3. To seek out and disseminate authentic information to provide better school facilities for instruction.

If we are going to do our best in carrying out these objectives, we cannot ignore the teacher nor the child in the classroom. If we design a school building that in any way impedes the effectiveness of the child or of the teacher, we are defeating our aim--the common denominator--a better education for our children. Most people will agree with this aim. Why are we not building as efficient and effective schools as we could? There are several reasons.

For example; an architect must sell his services. He must put something in a school that to him is important. If he has not been in communication with the educator, if he has not completely understood what the educational programs to be carried on in this school are, then his selection of the things he is going to put in the building may not be in keeping with the best interests of education. However, he must publicize the things that he thinks are important in order to get visibility and recognition. He must have reasons why he should design the new school building.

People in industry, if they are not in communication with the educators when they design their products may be designing and publicizing and selling products that are not in keeping with modern educational philosophies and practices. But they, too, must publicize and sell their products. If they are misguided, they, too, will be giving visibility to "gimmicks" of construction that aren't helping education.

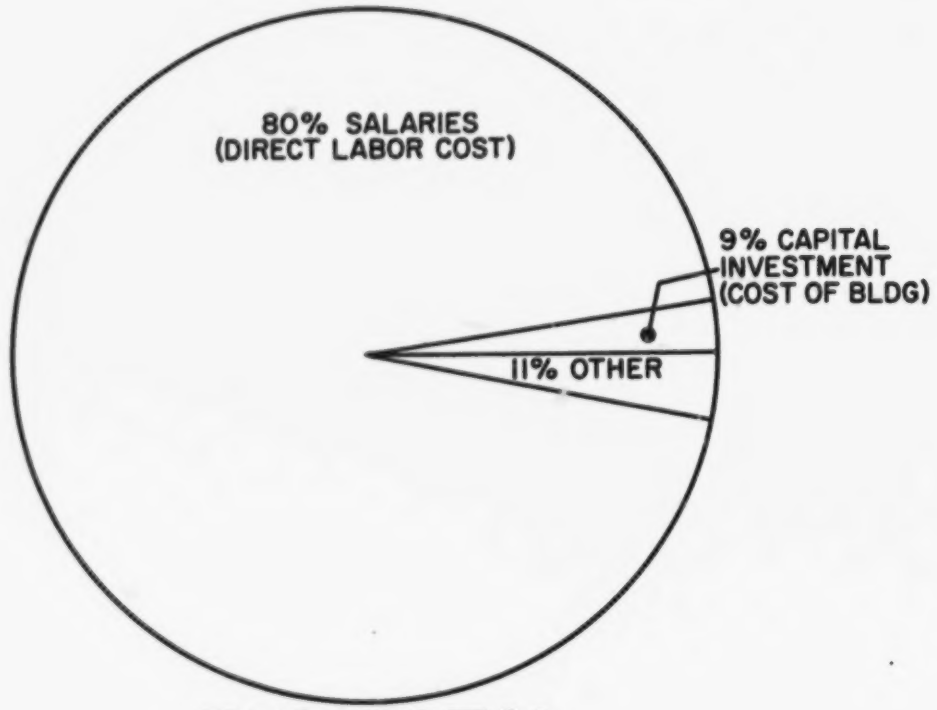
If this is true then we have a job of communication and, interestingly enough, we don't in most cases have to teach people things that they don't already know. It is merely bringing them into focus in a little different perspective than people have been in the habit of viewing. For instance, if we saw a manufacturing concern train all of their production employees in the use of the latest tools of production, and then saw this same firm put the same people to work on a bench with a screw driver, we would say that they were quite stupid. We know they wouldn't last long because in this day and age when the emphasis is on competition not only from the price standpoint, but also from the quality standpoint, industry could not survive if it were not using the most efficient production means available. Yet in our schools aren't we being just as silly if we are building schools that do not permit the use of modern teaching tools?

It isn't only providing these teaching tools. We must also provide environment that makes it possible for the children to actively participate in the learning experience. It doesn't matter how good the teacher is or how good the teaching tools are if the classroom is so hot and stuffy that the children cannot remain alert and awake, very little of the value of the teacher and the teaching tools will be realized.

In industry today, every effort is made when a new building is planned to make that building as efficient and as effective as possible. But when we get to a school building, all too often we are just concerned with having a roof over their heads with no thought to the efficiency of the student or the teacher in the classroom. In industry, when buildings are built, every effort is made to see to it that value is received for every dollar spent. Shouldn't we be just as concerned about getting our money's worth for the dollars that we spend for school buildings? Shouldn't we recognize this as one of our responsibilities to the taxpayers to see to it that we do get our money's worth for every dollar that is spent on school construction?

When we are designing our school buildings, we can't just look at the number of dollars we are spending. We must also look at the amount of education or the effectiveness that the dollars will bring. We have probably all heard many individuals attempting to make personal or political hay with cutting the cost of the school buildings. We have not heard these people talk of the total cost of education in the same breath. Such talk, to have validity, must consider the total cost of education--not just one part.

If we look at the total cost of education, we find that it is made up of approximately 80% direct labor salaries. This isn't just teachers' salaries, this includes administrative salaries as well. Less than 9% of the cost of education is represented by the capital



THE TOTAL
COST OF EDUCATION

expenditures or the cost of the buildings themselves. In other words, if we were to cut 10% of the cost of the building, we would not have affected the cost of education by 1%, yet we may have cut the effectiveness of education by a pretty high percentage. When salaries constitute the major cost of education, shouldn't we be thinking in terms of building our school fa[illegible]es to permit the salaried people to operate as efficiently and effectively as possible? Aren't we really wasting a lot of the dollars that we spent for our teaching staff if we are providing school buildings that are hindering rather than helping them do a better job of teaching?

In many areas we have made real sound progress in the past in improving environmental conditions in our educational plants. For example, if you were to check the lighting facilities in our new school plants

as compared to our new commercial buildings, you would find in most cases the lighting is at least as good and in many cases better than they are in many of our commercial type buildings. But we still have a long way to go in getting recognition of all of the things that are important to efficiency in the classroom. A recent publication in my own field carried an article pointing out the expanding use of air conditioning in such areas as new office buildings, apartment houses, hospitals, hotels, shopping centers, and industrial buildings. Nothing, however, was mentioned about schools. Isn't a school building just as important? Shouldn't we bring this importance into focus? I believe that our mechanical industry is failing when they are assuming that all other buildings should take advantage of the added efficiency that can be obtained through air conditioning and ignoring these same values when applied to schools.

It is extremely important that we recognize this in schools because there are very few other situations where we have as many people crowded in as small a space as we do in a school plant. The body heat alone from the student body in one classroom is often enough to heat a five room house when the temperature outside is 32 degrees.

Air conditioning is only one area where the environment and teaching efficiency of our school plants could be improved. There are obviously many more.

We must recognize the areas of our own responsibility, then accept these responsibilities. We must have people literally crusading for better schools. When we get this, we are bound to have a better educated voter in the community. The people of the community will be ready, willing, and able to provide the best possible facilities to assist the teacher and the students in the classroom.

IMPROVED VIEWING CONDITIONS

ADRIAN L. TERLOUW, Educational Chairman,
Eastman Kodak Company

Every day several million students are being asked to look at something at the front of the classroom and learn.

There is a real and pressing need to set up certain standard practices to make sure instructional materials are legible.

The legibility of anything viewed in the classroom is tied to the characteristics of human vision. In order to discriminate between two symbols such as 5 and 6, a capital N and V, or F and E we have to meet several "seeing" conditions.

These factors fall into two main categories:

1. The design of the material displayed
2. The conditions under which it is displayed

Since these two factors are so closely interrelated we can't set up standards for one independent of the other. So in concentrating on design we are going to have to make certain assumptions about viewing conditions.

Viewing Conditions

Although we can't assume that ideal viewing conditions can be achieved at all times in every classroom, some minimum standards have to be assumed. Here are the ones on which the present discussion is based:

For material viewed by reflected light

The illumination on the surface to be viewed is equal to or somewhat greater than that falling on other surfaces within the field of view.

The illumination on the task area is at a level between 25 and 50 foot candles.

The direction of the illumination of the task area is such that no surface glare (specular reflection) is produced.

There are no bright areas within the field of view (sky, concrete, snow, glass block installations, sunlit objects in the room) that have a brightness in excess of the instructional material.

For material viewed by projection

A screen image with a long dimension 1/6 the distance from screen to farthest viewer. A value of 1/8 is tolerated.

A screen image brightness produced by the projector at least twice as great as any bright area in the field of view. This must hold for every member of the class.

A minimum screen brightness of 9 foot-lamberts for every member of the class, even those off to the side at the greatest viewing angle. A level of 20 foot-lamberts is preferred.

The relation between the brightness of the screen with the projector turned on but the lens capped (non-image brightness) to the brightness of the screen when illuminated by the projector with a blank slide with a clear mask opening should be appropriate for the material being shown.

Class of material	Non-image brightness / Projector image brightness
Class A	
Full scale B & W and Color where pictorial values are important and color differences must be discriminated.	$\frac{1}{100}$ ($\frac{1}{300}$ preferred)
Class B	
Color diagrams and continuous tone B & W in high key.	$\frac{1}{25}$
Class C	
Simple line material such as text, tables, diagrams and graphs.	$\frac{1}{5}$

Good optical performance of the projector lens to give a sharp image free from noticeable (from audience position) color fringing and flare.

For materials like text, tables, graphs and outline sketches, experiments have shown that the smallest symbol to be discriminated must subtend 9 minutes of arc. We can transpose this into a working table:

Viewing Distance	Minimum Symbol Size*
128 feet	4 inches
64 feet	2 inches
32 feet	1 inch
16 feet	1/2 inch
8 feet	1/4 inch

*This is the height of the body of the type face. When upper and lower case are used it is the body height of the lower case characters.

Direct Viewing vs. Projection

When the proper conditions for projecting the class of material being shown can be met it is usually preferable to use a projector for presenting the material to view because of:

Economy of space and convenience
Versatility
Effectiveness
Cost

Multiple-Use Art Work

In technical and scientific presentations it is often desirable to use the same art work of graphs, tables, diagrams, etc. for publication and the production of transparencies for projection. This can be accomplished by adopting drafting procedures based on a 6W* maximum viewing distance. The resulting art work will reproduce with an appearance that is compatible with the type face and page color of current technical journals.

*"W" refers to the longer dimension of the projected image. For example a 6W viewing distance for a 3 x 4 foot image would be 24 feet; for a 4 x 6 foot image it would be 36 feet.

Television as a form of projection

Most people don't like to sit too close to the picture tube because they are conscious of the lines that make up the image. This occurs at about 4 times the tube width. With a 21 inch tube this minimum distance is about 7 feet. At the other end of the scale we find it is not uncommon for people to sit 18 feet (10W) or 20 (12W) away. Obviously charts, graphs, sketches and photographs designed for 6W standards will not be legible at these maximum distances. A design point of 12W is advisable for material that may be used on television.

This calls for a letter twice as large as that specified for the 6W viewing distance. Obviously this greatly reduces the amount of data that can be presented to the television viewer at one time. It also means that the general views so useful for orientation may not be satisfactory on television although they are admirable and effective when projected at 6W standards with an optical system. Television calls for a much bolder treatment.

Universal table for symbol height

If we specify the minimum symbol height as a fraction of the narrow dimension (H) of the art work area to be reproduced on the screen we can create a table that indicates the minimum size of characters for a variety of maximum viewing distances.

Distance of farthest spectator	L/H	Minimum height of symbol 6-3/4"x9" art work	9 x 12 art work
4W	1/75	.09"	.12"
6W	1/50	.13"	.18"
8W	1/35	.19"	.26"
10W	1/30	.22"	.30"
12W	1/25	.27"	.36"

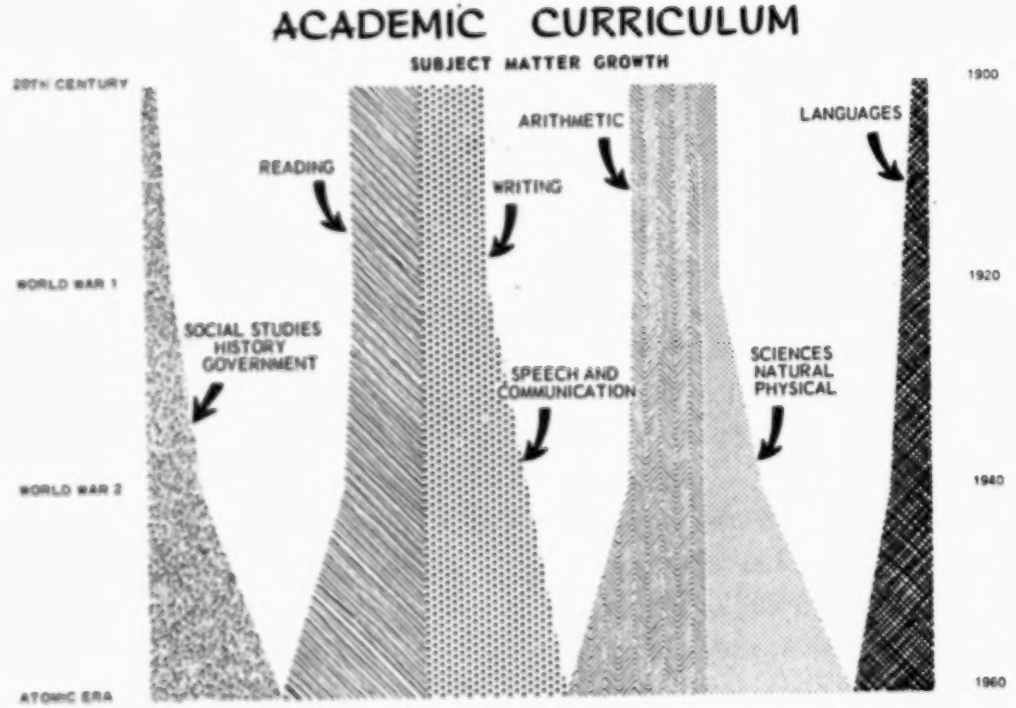
AN APPROACH TO PHYSICAL CONTROL OF THE LEARNING ENVIRONMENT

G. B. WADZECK, Superintendent, San Angelo City Schools, Texas

Many of our national leaders have said, "If we survive as a nation, and remain a leader among nations, the decisions will not be made on the battlefield or around the conference table, but rather in the classrooms of this nation as we compete with other nations in education the next generation."

Our present buildings, equipment and educational tools simply will not allow us to transfer the knowledge now accumulated to the next generation.

Improvements in your existing school environment can be made on the basis of this accumulated knowledge. Before I discuss an important factor affecting the learning environment, I would like to present for your consideration some background data on the academic curriculum, educational demands, and transfer of knowledge.



Academic Curriculum

In the accompanying chart I have attempted to present a reasonable picture of what has happened to the academic curriculum since the year 1900. At

that time our needs were considerably different. A fairly sound program of the so-called "3 R's" was adequate for better than 90 percent of the students enrolled in our schools.

The main point to be stressed was that a person could read with reasonable speed and reasonable comprehension. Considerable effort was given to teaching writing in a beautiful, flowing style, and the person needed to know numbers sufficiently to figure small problems and keep a simple set of books. Other subject areas in the curriculum were concerned with English, reading some small amount of Social Studies and History, Government, and about 4 percent needed instruction in Science. Some higher mathematics and Foreign Language qualified for college entrance so that students might enter the professions.

So that we may be as brief as possible, let us jump to the year 1960 and recognize that we can no longer be satisfied that we teach reading as sufficiently as we did in the past. A child must read faster and understand what he reads better or he will never cover the materials to be found in the libraries.

You will notice that writing has been sharply curtailed. Other forms of communication and speech have replaced the beautiful, flowing handwriting and its importance. At the present time, writing is confined to a legible style. Some people have commented that a man is not really famous until he can write so that no one can read his signature or scribbling. I do not vouch for this as a criterion or evaluation, but for your own satisfaction, view some of the signatures and handwriting of our better-educated people.

In the field of arithmetic or numbers, we are now on the threshold of an era of technology that will require more higher material for the average person than was required for our advanced students in the past. We no longer can be satisfied to figure the number of acres in a plot of ground, but must deal in the field of mathematics to figure the thickness of materials that we cannot see with a microscope.

Take the field of science and you will find more advancement in the last 30 years than we had in the form of accumulated knowledge in science prior to that date. Things that were listed as scientific laws 30 years ago have been disproved and have caused our scientists to say that a certain thing may be true rather than this is a scientific law and is true.

The field of Foreign Languages that was primarily used for the profession of medicine and to some extent, for the training of the mind, is no longer satisfactory. The world is growing smaller as a result of our technical know-how and we must teach foreign language for the purpose of communication with one another rather than simply the training of the mind.

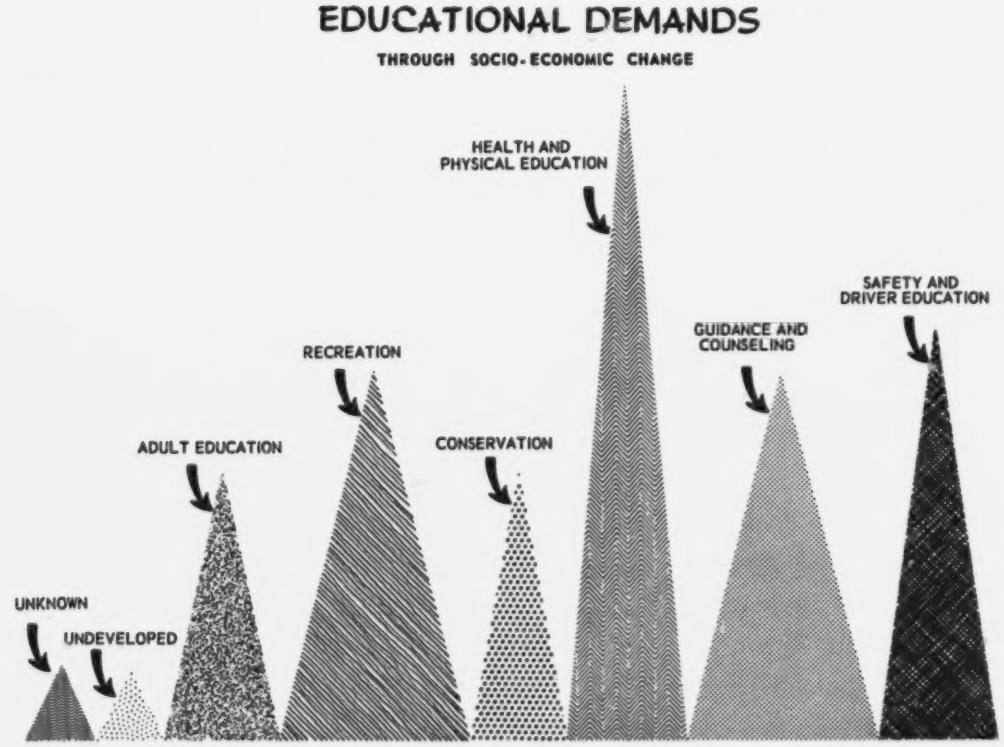
In the field of Social Studies, we have made more history in the last 30 years than we had in the textbooks prior to that. With this increased volume of material to be taught, we still have one hour a day to teach American History or to teach many other classes and in many cases, less time than we did years ago.

If we would only teach the academic program, we would still need more time and better tools to do a job as well as it was done a few years ago. I do not wonder that the educator is being accused of watering down and softening the curriculum. This presents but one phase of the program and I would like to present for your consideration a second phase which I call Educational Demands Through Social Economic Change.

Educational Demand

This phase does not deal with added pupil areas such as the education for the slow, for the physically

handicapped or hard of hearing or deaf child. Those programs are added pupil programs and we are confining this duscussion to subject areas. I am sure that you can think of other areas that should be included. The data presented in this second chart has been arranged in the form of pyramids. This was done to show that these programs had a small beginning and have gradually increased in demand as our way of life has changed.



Look at the first pyramid, Safety and Driver Education. There was no thought given to a program of this nature until our use of the automobile had reached a point of killing a large number of people on the highway. I would not try to argue for or against this program as being the responsibility of the public school; however, I believe we will all agree that it is someone's responsibility and should be provided for our next generation.

In the area of Guidance and Counseling you will note that some few individual teachers have counseled their students since the beginning of time. The need did not justify an organized program until approximately 40 years ago. But since then it has grown tremendously. In the field of Occupational Guidance alone, students now have to choose from among over 1,000 professions and occupations for every one that existed in 1900. How will the child find the proper position to fit his abilities and secure the proper training without such a program?

In the field of Health and Physical Education, we did have the recess period in 1900 that has grown gradually to be a program of demand as a result of more and more of our people living in highly congested areas with little opportunity to develop the physical growth of the child.

Conservation of natural resources and manpower are among the many forms of conservation which is becoming more important in the training of the adult of the future. Conservation is a newcomer in an ever growing list demanding educational training.

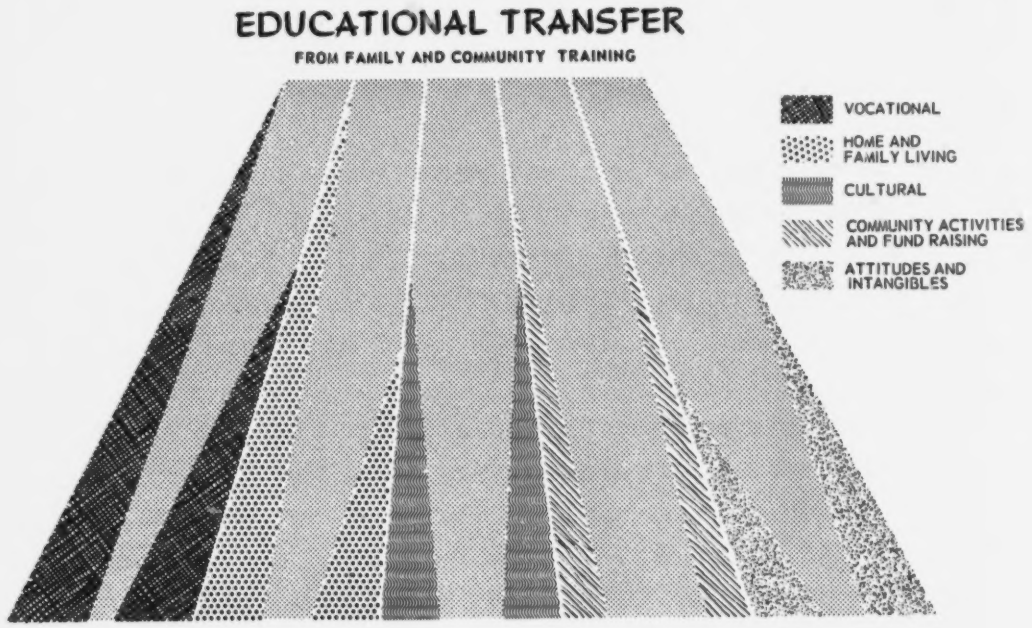
Recreation and proper use of spare time is becoming more and more important with the 30-hour week just around the corner. Some of our people are talking of a 20-hour work week within 10 or 15 years.

Adult education is another newcomer. In my opinion, it will become more and more important to adjust our adult population for the world of tomorrow. You will notice two small pyramids appear on the chart listed as Undeveloped and Unknown. I am sure that we have many other changes and additions that will be placed as a responsibility of the public school.

All of this has been added to the curriculum and has had to be absorbed without additional time and very small additions in the field of personnel and finances to do such a job.

Educational Transfer

On a third chart, which follows, the Educational Transfers from Family and Community Training to the Public Schools are shown. The key on the chart shows the part that is still being handled by the family and community and the amount in each area that has been transferred to the public school.



Observe the chart for Vocational Training. A number of years ago, the father or an uncle or a friend of the family would teach the sons their occupation; such as, the blacksmith, the carpenter, brick layer and the plumber. Under our present system of Union control, the average father is not allowed to take his son on the job until he is qualified as an apprentice. As a result of this change in our way of life, practically all vocational training has been transferred to the public school and special vocational training has been transferred to the public school and special vocational schools.

In the area of Home and Family Living, the parents still make a health contribution. However, a large portion of this training is being transferred to the public schools. I have heard many people say that the American home has deteriorated considerably, and that all boys and girls should be required to take at least two years of training in home and family living education. As arguments for such a program, they point to the high divorce rates, juvenile delinquency, and other problems that were originally the sole responsibility of the home. Many more say that the home should still carry such a program, others say that they agree; but, if the home does not, can we afford to fill our institutions with the juvenile delinquent, mental health cases and other by-products, and pass this expense on to the taxpayers?

Let us look at our Cultural Development. Back in the era of 1900 to 1910 or 1915, you saw few school bands, orchestras, art courses and many other cultural courses taught. If they were taught, it would only be found in private schools. This area of development is becoming more expensive and how many people would say it should be discontinued?

Also on this chart we find Community Activity and Fund Raising. It would surprise many of you to know how many requests for participation in certain community activities are rejected by the educator for

every one that is allowed. The educator that holds the line in this area finds that he has a multiple of the requests that have moved into the school that are time consuming and just another problem for the teacher. The proponents of this activity point to the value received in the development of citizenship and the general development of the child in our way of life. The last group is called Attitudes and Intangibles; e.g., the many little things that have been handed to the schools as their responsibility. If these problems concern you, let us search for answers to them.

The subject of this topic may have given you a clue to the way I feel the learning environment may be improved through air-conditioning. "How do we condition air today?"

We condition air by circulation, by mechanical means and outside temperature and we also spend a large percent of our budget trying to design a building to use the natural flow of outside air. The next step in air conditioning is to filter and cool hot air or to complete the cycle for year-round air conditioning. It may be possible to eliminate a dependence upon nature's flow of air and, at the same time, save a considerable amount to be applied on mechanical air conditioning; provided we instruct the architects and engineers to design our buildings for peak efficiency with year-round mechanical air conditioning.

San Angelo, Texas now has one air-conditioned elementary school building and is planning a two thousand pupil high school with a complete air-conditioning plant for year-round use. The operational cost of the elementary building for nine months was approximately $2.00 per student more than with the steam heating system in some of the other buildings and 90 cents per student more than with a forced-air heating system.

The original cost of installation is a question mark. Some say it costs about $2.00 per square foot. I would like for you to be the judge. At the same time that we were building this building, we were constructing seven other buildings. The Belaire School was next to the cheapest of the eight projects with air-conditioning included. We believe that freedom of design, as a result of eliminating the control of the flow of outside air, has made it possible to have air-conditioning at practically no additional cost.

What are the educational advantages? With outside air temperature near 90 degrees Fahrenheit, the teacher and children in air-conditioned environment are fresh and efficient near the close of the day. Those less fortunate are losing their operating efficiency before half of the day has passed. A child with breathing difficulties could be a regular student if working in filtered air and a home-bound case without filtered air. Yes, the children and teacher can both work longer and more efficiently with less fatigue in an air-conditioned climate.

AIR CONDITIONING AND LONG-RANGE PLANNING

FRANK NEAL, Western Director School Planning, Minneapolis - Honeywell Regulator Company

If the heating, ventilating, and air conditioning systems of our new school buildings are not better or do not compare favorably with the systems being installed in the commercial buildings of a comparable quality in the area, it is obvious that we are failing to conform to the best present day practices.

Any school building construction is a long-term commitment. For as many as forty to fifty years or even longer, the building will not be sold, traded or leased. There are few speculative possibilities for the district of selling it and making a "killing" on the building because of its external appearance, or leasing it to a wealthy tenant who will install the air conditioning himself. The building will be owned, operated, maintained, and used as a teaching tool by the district for the effective life of the building.

A school building is only useful and successful as measured by its achievements as a teaching tool. Its educational function is to be a learning environment.

The full value of dollars spent for school buildings is obtained only when the facilities provide for a superior type of student learning.

While both architectural and educational policies have changed considerably in the past half century, evaluation of the thermal environment for schools has been slow to respond to many of the newer developments. Several factors have been influential in retarding the best type of thermal environment. In many cases, the most serious drawback has been the complete disregard of the effect of the thermal environment on the learning activities of the child.

Forty to fifty years ago when many of our present schools were built heating and ventilating systems were copied directly from commercial buildings, not only in system design but in facilities and equipment as well. This is certainly not true today. The minimum type heating system with manual operation of windows for ventilation still persists in spite of the fact that these practices have long been outmoded in commercial type buildings. Such schools are modern only in their exteriors.

To expect a teacher to operate windows for ventilation or radiator valves for heat in the world of automation today is not only an insult to the teacher and her ability, but a waste of trained manpower and a failure to use good economical business practices. In the ordinary business world today it is an accepted criteria that it is almost impossible to hold a competent secretary for a normal rate of pay unless you have an air conditioned building. Yet schools expect to be able to keep classroom teachers who have completed a full college education and specialized for their particular teaching job in the antiquated thermal environment which exists today in the major portion of our schools. If we are to believe the average business man today, this factor alone would be enough to cause a teacher shortage if we could assume that they were

PANEL (L to R)
FRANK NEAL, Western director School Planning, Minneapolis - Honeywell Regulator Company, Chairman
DONALD R. GOSS, Architect, San Angelo, Texas
ROSS TIPPETT, Engineer, Tippett & Gee Consulting Engineers, Abilene, Texas
J.S. HAMEL, Mechanical Engineer, Burbank, California
ERNEST McCOY, Architect, Bakersfield, California
THERON L. McCUEN, Superintendent, Kern County Union High School and Junior College District
G. B. WADZECK, Superintendent, San Angelo City Schools, Texas (not shown)

as independent and as demanding as some secretaries.

To expect that today's classroom and facilities should achieve no better thermal environment than those found in schools built forty years ago is to assume that the curriculum, teaching methods, mechanical systems, and our standard of living have not advanced in the past half century either. Classrooms designed in the days of the "horseless carriage" and for a formal discipline doctrine of education are today only obstructions to competent learning. Unfortunately, too many educationally obsolete classrooms with antiquated heating systems are being perpetuated in modern building programs. In the drive to achieve real construction economies in the thousands of classrooms that are being built today, we have in many instances apparently lost sight of our obligation to build <u>better</u> classrooms.

One area of the school facility which requires far more attention than it has been receiving is the thermal environment. Rooms with a poorly planned thermal environment tend to dull and inhibit effective teaching and learning. The classroom environment has a definite relation to learning, both in attitudes and in the effectiveness of the teaching procedures.

Effective planning requires that one look not only at the present, but also to the future. School planning has too often been in terms of the present on a foundation of the traditional. The result is a thermal environment which is educationally obsolete from its very conception. Long term planning demands that serious attention be given to a consideration of our standard of living trends and a projection of these trends into future building and facility requirements. What type of mechanical equipment and thermal environment is increasingly becoming within the financial ability of the American citizen today? What characteristics will identify the modern classroom ventilation system from now on, or even twenty years hence? Economical planning of schools requires that future educational functions and procedures be considered at the time of original construction. Revision of an obsolete heating system after five years can result in its complete abandonment if it is improperly designed for modernization and improvement by the addition of air conditioning.

A program for new building construction provides one of the best and most stimulating situations in which to upgrade the entire educational and mechanical system of the school. The evaluation of the thermal environment, in terms of the most advanced educational thinking, and the visualization of this environment, in terms of the physical facilities to achieve this environment to augment the educational program, constitutes modern school planning.

The more functional types of schools are designed educationally before they are designed architecutrally. This would include the visual, thermal and auditory environments as required by the educational program. Good planning of a school by an architect requires that he be provided with a set of educational specifications from which to work. It then becomes his responsibility to develop the architectural and mechanical plans consistent with the designated educational program to be facilitated.

The heating, ventilation and air conditioning industry would like to assist architects, engineers, and school people in the planning of today's and tomorrow's schools by providing answers to the following questions which they should be asking:

1. What are the educational specifications for the thermal environment of today's classrooms?

2. Is it possible to achieve this desirable physical environment?

3. Is a good air conditioning system educationally,

financially and architecturally compatible with the problems encountered in classroom construction?

4. Is the quantity and quality of education improved by air conditioning?

5. How does the thermal environment of our schools compare with commercial buildings of similar construction?

6. What types of air conditioning systems are being used in recently constructed schools?

7. What are the costs and savings as a result of air conditioning?

8. What is the trend in the use of air conditioning in schools today?

MASTER CONTROLLING THE THERMAL ENVIRONMENT

FACTORS AFFECTING THE CLASSROOM THERMAL ENVIRONMENT

DALE D. BRIGGS, Western School Representative,
American Air Filter Company

A general opinion which is apparently held by each school administrator in our country is that the thermal environment problem in his district is different from that in any other. And yet, the elements which create the thermal environment appear to be much the same, regardless of the geographical area.

There is a common thread which runs through the philosophy of all school planners, whether it be groups, individuals or institutions. There are certain facts which are accepted by each of these school planners. The visual environment--the acoustical environment--space--storage and other environmental elements are fairly consistent throughout the country. Whether or not these accepted facts are good, bad or indifferent, I cannot say. But I do say we must recognize the fact that they are accepted.

The classroom thermal environment in any given geographical area varies so little from that of another geographical area that it becomes negligible. Therefore the problem is the same wherever you might be situated geographically.

PANEL (L to R) JAMES D. MacCONNELL, Director of School Planning Laboratory and Associate Professor of Education, Stanford University
CHARLES S. STOCK, Finance Chairman, School Facilities Council
DALE D. BRIGGS, Western School Representative, American Air Filter Company
HARRY LOGAN, Engineer, Western Asbestos Company
DOYT E ARLY, Architect, Division of School Planning, California State Department of Education
THOMAS O. McCARTHY, School Representative, San Francisco Division, Minneapolis-Honeywell Regulator Company

These are the accepted facts which create the thermal environment:

Enclosed space. In order to have a classroom, a given volume of space is generally enclosed by four walls, a roof and a floor. By erecting these four walls we create an effect on the air inside the structure. We have either prevented or dampened the effect of the wind on the air inside the space. No longer can the sun shine directly into the room. No longer will rain fall through this air inside the enclosure.

Thirty children. There will probably be thirty children within this classroom. These thirty children generate a minimum of 9,000 BTUs per hour and with moderate activity will add as much as 20,000 BTUs per hour of heat into the classroom. I doubt very much that any of you, I certainly know that I could not, employ thirty people to work for me in a room 30' x 30' without some means of air-conditioning. And yet, it is under these conditions that our children must live and learn--by law.

Artificial light. Sufficient artificial light should be provided in each classroom to maintain a suitable visual environment for the children. This is a must in spite of all the expense and effort expended toward the use of daylight. In the average classroom, the minimum light to produce an adequate visual environment consumes 3,000 watts of electrical energy. In terms of heat, this is equal to adding 31 more children to the classroom. One BTU of heat is best visualized by seeing and feeling the amount of heat released from one common kitchen match.

Solar heat. The sun will shine. It may be shining through clouds, rain, snow, smaze, haze, smog or fog, but we can rest assured that it will shine. The amount of heat supplied to the classroom by the sun

Anervent installation in a typical high school classroom at Clovis,California. (photo by Sturtevant)

varies from 1,000 to 50,000 BTU hours. Conservatively speaking, you will find at least 10,000 BTU per hour heat gain from the sun on an average winter day.

These are the conditions which prevail in classrooms across the United States. It is these conditions which create the thermal environment in the classroom, and it is these conditions over which the mechanical system must have control if it is to provide the thermal environment most conducive to learning.

In the modern classroom the basic requirements which must be met by the heating and ventilating system selected are:

Rapid heating. There must be sufficient heating capacities provided to quickly bring the classroom up to the temperature each morning as it is desirable to have warmth and comfort for the pupils as they enter the classroom.

Air for ventilation. Provision must be made for a continuous introduction of a fixed quantity of tempered outdoor air for the elimination of odors and excess humidity during room occupancy.

Air for cooling. Provision must also be made for the introduction of larger quantities of cool outdoor air which may be mixed with recirculated room air to discharge into the room at 10° to 20° F. cooler than room air temperature. This cool air is required to prevent overheating due to the heat gain from the sun, the heat given off by the pupils and teacher, and the heat given off by the artificial lighting system.

Automatic control. Because of variable occupancy, activity and orientation, a means of responsive automatic control is necessary to provide a balance of the above factors on a room by room basis.

Mechanical cooling (air conditioning). Crowded conditions are forcing more and more schools to operate on a year round basis. School buildings are being used as never before for community and extra-curricular activities. Provision should be made now for future economical installation of a complete air conditioning system.

Amervent installation in a typical elementary classroom at Sanger, California. (photo by Sturtevant)

A MASTER PLAN FOR THE INTEGRATED CONTROL OF THE CLASSROOM THERMAL ENVIRONMENT

HARRY LOGAN, Engineer, Western Asbestos Company

In 1941 Dr. D. B. Harmon wrote a paper which set forth the results of exhaustive studies on children of primary grade level as they reacted in their learn-

ing process to the physical environment in which they were placed within a typical classroom. These studies pointed out very clearly that improper conditions of thermal, audio and visual environment could potentially reduce the receptivity of the child to a point at which his time in the classroom was academically wasted. Also, detrimental physical effects were noted, such as poor posture, eye strain, etc.

We felt that a system of automatic devices could be employed whereby all the facilities making the physical surroundings of the child in the classroom could be controlled integrally. This master plan would free the teacher from the task of adjusting and manipulating the various single controls now used, enabling her to perform her teaching duties with confidence, knowing that the learning environment was at the optimum.

The first problem was lighting. It has long been recognized that toplighting (or skylighting) where properly controlled against heat transmission and brightness, could be used as illumination within a classroom for the greater part of the school year. After several years, a proper light and heat control device was developed. It consisted of a series of major and minor louvers so arranged that only reflected and diffused light was allowed to enter the classroom. The device also permitted a complete disregard for orientation or sun position. It was tested by reliable agencies and met all the requirements for proper control which were stipulated by the manufacturer.

The next step in the development of this master control unit was the addition of an Audio-Visual system for skylight control device which would not project into the room or light well and yet have a simplicity of operation which would make Audio-Visual work more practical for the teacher. To accomplish this end the control people worked very closely with us.

Typical classroom at Sidney Elementary School, Castro Valley, California showing daylighting control device in place over skylight. (photo by G. Moulin Studios)

Now, having controlled daylight, it was then necessary to control artificial light. A special photoelectric cell was developed for one point in the school which would activate a special supervisory data center panel in the Principal's Office. As daylight diminishes to a minimum at the task level, a pre-determined amount of artificial light is turned on by the cell. As daylight further diminishes, the cell controls the balancing rise in foot candle level of the artificial illumination.

The next step was the development of the luminaire to be used with daylighting. A special luminaire was developed, made of an expanded aluminum honeycomb diffusing material, which has a most desirable

low surface brightness. The entire luminaire structure became very simple and by the same token economical.

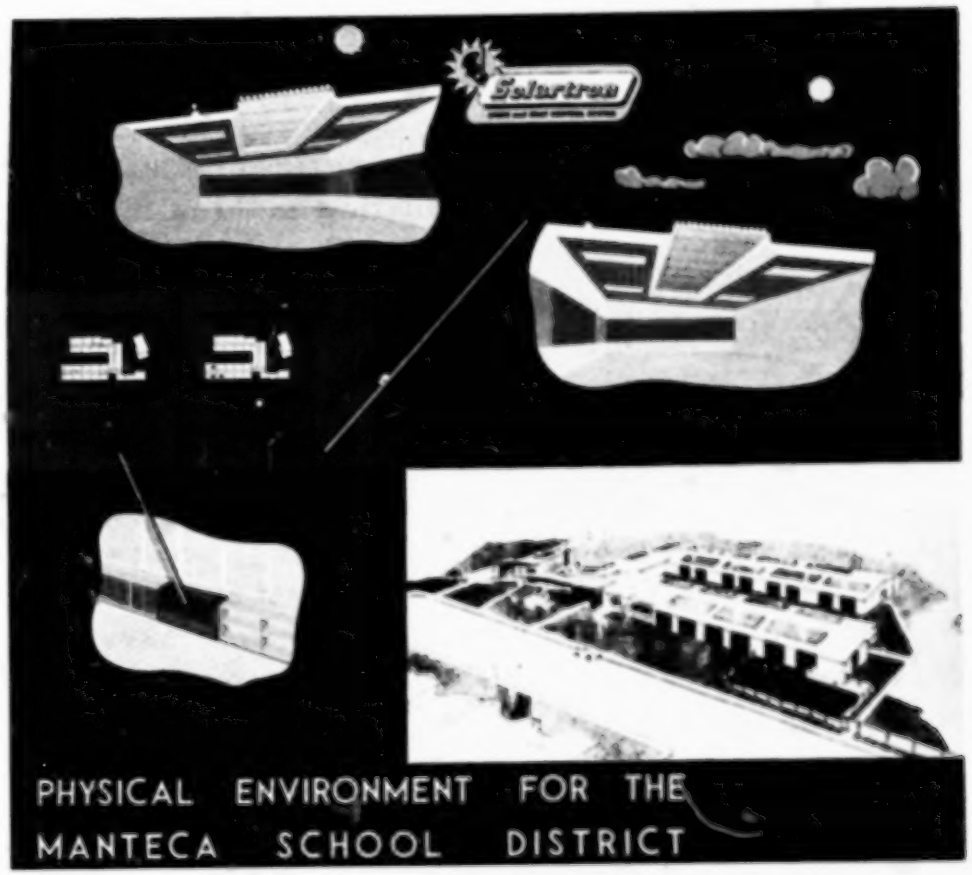
The last step in this planning was to coordinate the unit ventilators with the control thermostats removed to the data center panel so that each room could be individually controlled from the Principal's Office. This also enabled the custodian or anyone so delegated to make a complete check of the school thermal conditions, room by room, without having to wander through the structure. In addition, an automatic reset button was put into the panel for each room, so that the control came from the panel center for any adjustment of temperature that was necessary.

Maintenance-wise the entire scheme is relatively trouble-free because the human element has been removed. All of the elements of the system are established features used in schools today. The only thing that has happened is that the molecules have been rearranged and put to work in this manner.

Mayo, Johnson and DeWolfe, architects in Stockton, California, decided to take advantage of the master plan program. As a result, the Sequoia Elementary School in Manteca, California, under the supervision of Superintendent Neal Hafley, is being constructed. All the components outlined above are being incorporated in this structure.

It is the opinion of the electrical consultants on this particular school that the savings in heating and lighting alone per year should run between five and seven thousand dollars, with a substantial increase in savings as the cost of utilities rise.

The school will be completed in the early part of February, 1957, and it is felt that it will be a milestone along the road of educational progress. But, it must always be remembered, that what we create today may not be the answer of the future. However, the Sequoia School is a far cry from the classrooms we have been constructing in the very recent past, and should at least point in a new direction for educational needs.



INTEGRATED CONTROL OF THE MECHANICAL EQUIPMENT IN THE CLASSROOM

THOMAS O. McCARTHY, School Representative, San Francisco Division, Minneapolis-Honeywell Regulator Company

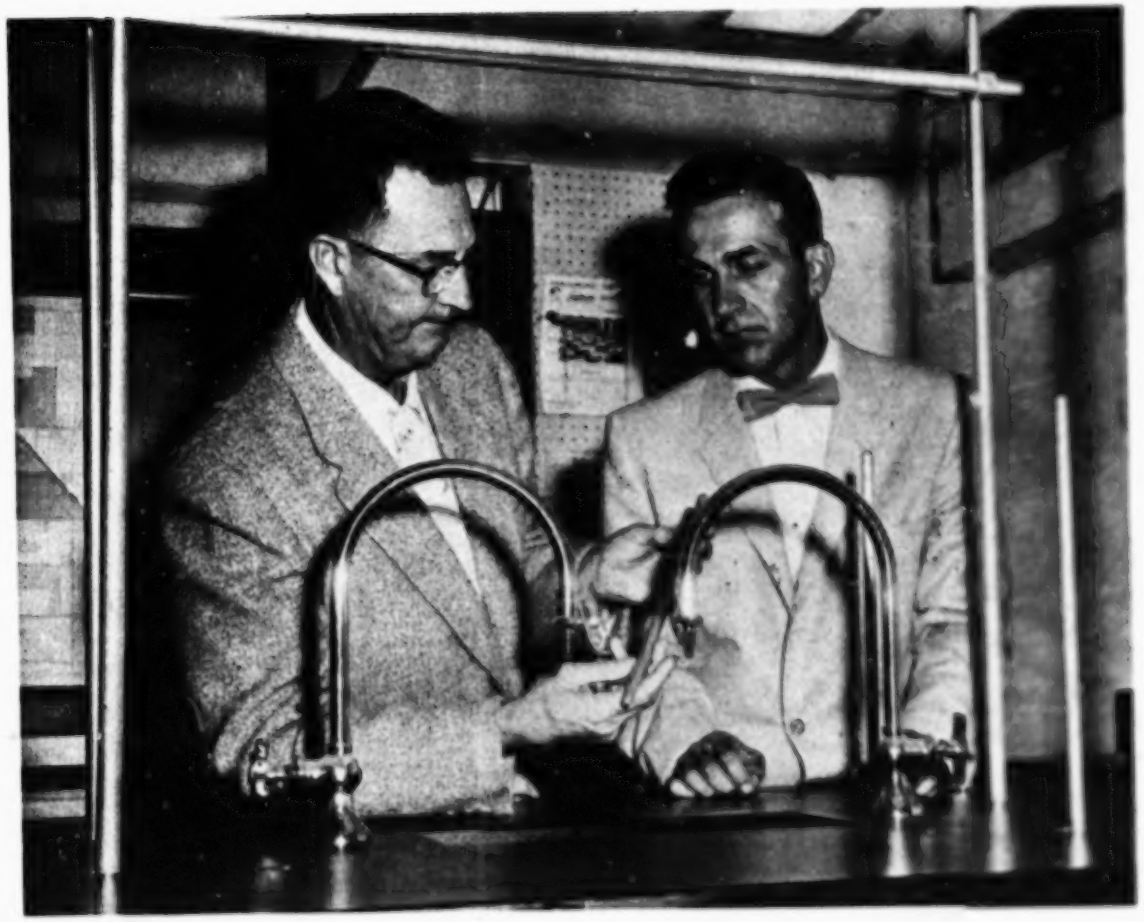
All mechanical equipment is designed and sold to the consumer under the assumption that it will be properly applied to the problem. Without proper application the best of equipment is worthless to solving

(Continued on page 110.)

part 4

improving the school environment through

FUNCTIONAL DESIGN



San Francisco Examiner

Scenes From The School Planning Laboratory

INDUSTRY

HAS CONTRIBUTED APPROXIMATELY $100,00 IN NON-MONETARY GIFTS TO THE SCHOOL PLANNING LABORATORY SINCE ITS INCEPTION SIX YEARS AGO. HERE, GEORGE E. HARRIS, ASSISTANT SUPERINTENDENT, CLARK COUNTY (NEVADA) SCHOOL DISTRICT, EXAMINES SCIENCE EQUIPMENT GRANTED BY THE KEWAUNEE COMPANY WHILE DR. FRED L. COOL, ASSISTANT PROFESSOR OF EDUCATION, STANFORD UNIVERSITY, LOOKS ON.

No. 4

CRITERIA FOR CHANGING NEEDS IN SCHOOL DESIGN

CHARLES W. BURSCH, former Chief, School House Planning, California State Department of Education, now Consultant, School Planning, State of Nevada

The physical facilities portion of the educational program lends itself better than any other phase of that program to objective review and appraisal. A school building is one of the few concrete symbols of education which literally can be seen, touched and evaluated objectively against the desired goals it seeks. Once erected, it stands for generations as a part of the educational program to serve measurably well or poorly, to praise or curse the foresight or short-sightedness of those responsible for it.

The physical environment is an important factor in the total educative process. It is difficult to gather objective evidence in this area since research is limited and difficult, but it is becoming considerably more apparent that the school plant can and does condition the educative process to a measurable extent. The planning of schools offers educators an opportunity to manipulate definitely controllable factors to the end that the school plant becomes a positive rather than a negative educational force.

It is considered educationally desirable to decentralize school service in a community. Experience has indicated that the building of large centralized school plants designed to serve all the community is questionable practice. The trend has been to reduce maximum enrollments and to limit the number of students assigned to one elementary school to 600 or less.

The trend is toward larger school sites. The recommended area for an elementary school of approximately 500 students is ten acres of usable land. A junior high school of approximately 1,000 students should have a site containing a minimum of 25 acres of usable land. High schools of 2,000 should have 50 acres, minimum and junior colleges, a minimum of 100 acres of usable land. The recommended (dimensions) proportion of such school sites would be in the ratio of 3 to 5.

After an educational appraisal of the grade and housing needs of the entire school district has been made, a grade-grouping assingment (i.e., Kindergarten--Sixth, etc.) is given a site and a saturation enrollment is set for that school. Against these assigned factors a Master Plan is designed to indicate the sizes and locations of all the buildings needed to house properly the educational services envisioned for that site. This Master Plan provides adequately first for the present needs and secondly for the orderly and economical provision of the anticipated total needs on that site.

The one big lesson learned during the past fifty years and more is that the most certain thing about an education program is change. The educational needs and concepts of today are sure to be different from the educational needs and concepts of the tomorrow that will come within the structural lifetime of the school buildings now being constructed. If today's schools are to lend themselves gracefully to the needs of tomorrow's educational program they must be designed now to provide the flexibility that later will be necessary if the physical plant is to encourage rather than frustrate educational progress.

The physical plant should provide adequate housing and facilities for all the school and community services for which the school district is responsible and which it can finance in addition to providing for all the students in its attendance area. If all such facilities cannot be provided within the limits of the initial construction, a Master Plan should indicate new or reassigned space for their inclusion in future construction plans. Because of limited funds, high building costs or other reasons many schools are conceived to provide only for minimum educational and community services. Educators must think and plan in terms of all the needed services.

All building spaces in which teachers and pupils together explore the educative process should be thought of as learning spaces. Such a concept requires generous indoor-outdoor areas with a maximum of flexibility to permit easy arrangement and re-arrangement of the space. Such a typical area might include a square-type classroom giving an indoor area of 961 to 1024 square feet. Immediately adjacent to this indoor space there might be an outdoor area of approximately the same area. The indoor area should be refined with a completely controlled environment and the best equipment obtainable. All storage units should be movable and designed to properly contain the materials to be stored. An informal flexible arrangement of activity and work areas should be properly related to the needs of the educational program. Running water and a drinking fountain available in the room would be a desirable feature for many schools.

The best plants of today are often unjustifiably used as a basis of criticism of older buildings. However, the best plants of today are not and should not be thought of as indicative of what schools of the future should be. The nearest defensible prediction of what the school plant of tomorrow will be is to recognize trends in educational content, methods, and practices and to design buildings that will be suitable if those trends persist provided, of course, the buildings also took care of the needed education today. Basic concepts and ways of thinking about school sites and buildings, if followed, will assure good plants for the future.

The photographs and drawings presented on the following pages indicate some recent practices in school design and construction in the San Francisco Bay Area of California which were visited by many of those who attended the Sixth Annual School Planning Institute.

A PRESENTATION OF SOME SCHOOLS RECENTLY DESIGNED AND CONSTRUCTED IN THE SAN FRANCISCO BAY AREA

The panel of architects: (L to R) MARIO J. CIAMPI, CHARLES F. MASTEN, TORBEN G. STRANDGAARD, DOYT EARLY, WALTER STROMQUIST, AND DEAN LILLIS

CUBBERLEY HIGH SCHOOL - Palo Alto (California) Unified School District

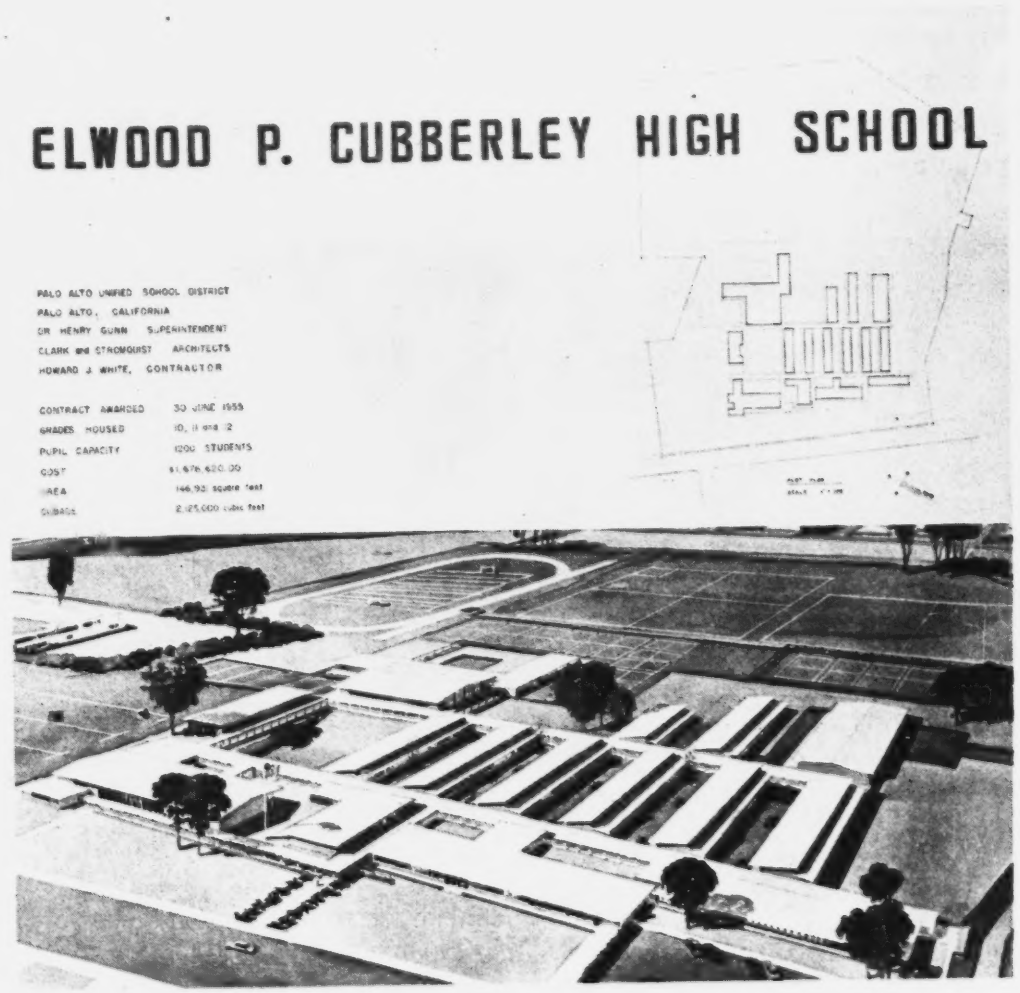
Ellwood P. Cubberley High School is a new plant for the Palo Alto Unified School District designed on a 35 acre site to accommodate 1200 students. Cubberley High School was designed and equipped by the co-operative planning of many groups of people. A Citizens' Advisory Committee met with the Board of Education to determine the general philosophy and the general program of this new high school. The primary purpose of these meetings was to design a building which would meet the specifications for a general plan of secondary education in the community. The architects for the district sat in on all of these meetings so they could translate the general ideas of the group into a coordinated plan.

Following these meetings, teachers, administrators, custodians, secretaries, and other people who work in our high schools were called in with the architect to refine the plans. Where student advice could be used, it was requested. Expert advice in special areas such as science, industrial arts, auto mechanics, homemaking and art was obtained from specialists in the State Department of Education, San Jose State College, and Stanford University.

Site Utilization: In designing this school the academic area for quiet activities (i.e. English, History, Languages, Math, Science) were located in the central area providing easy access to the Library and Administrative Offices. Around the periphery of the plant were located the noise-producing group of buildings which includes Shops, Homemaking Units, Gymnasium, Music, Cafetorium and Swimming.

Administration: The Administration facilities include offices for counsellors, nurse, principal, vice-principals, and adult education.

Library: The Library contains conference rooms and storage space for instructional materials.

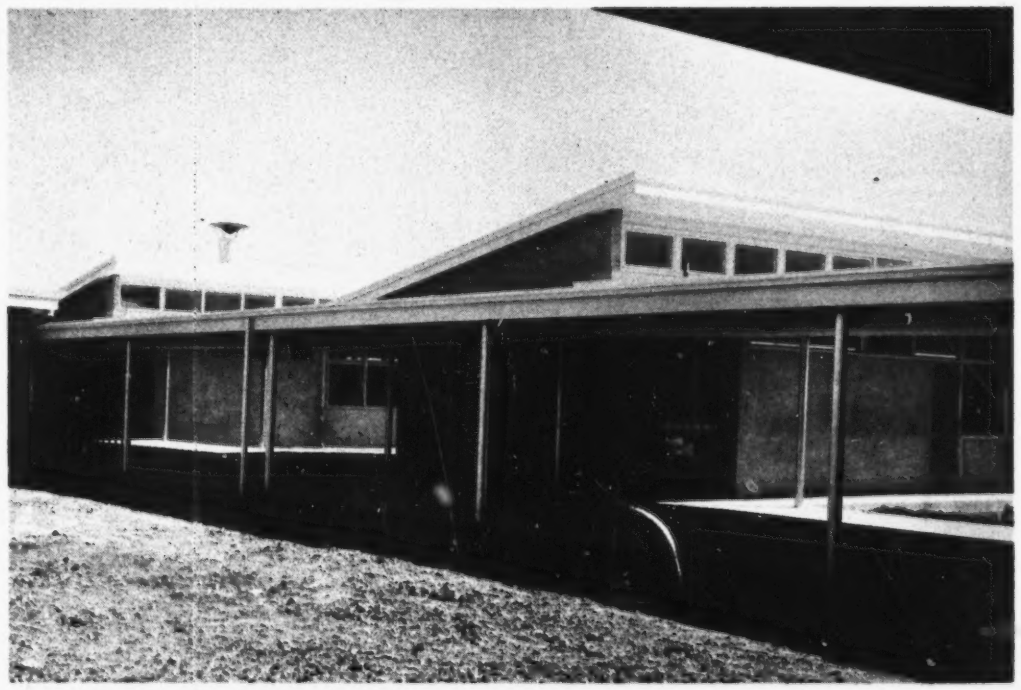


Cafetorium: The Cafetorium with a seating capacity of approximately 1,000, includes a large stage and makes provision for a student snack bar and an outside eating area.

Music Building: The Music Building provides for a choral room, an orchestra and band room, practice rooms and storage space.

Gymnasium: Gymnasium includes separate Boys' and Girls' Gymnasiums, Exercise Rooms, and Locker and Shower Rooms.

Typical Classroom Units: The clerestory section was adopted for tri-lateral light to provide an even distribution of light in the classrooms. The academic core of classroom units includes a Little Theater with raised platform and also includes an amphitheater which will be used for numerous outdoor programs including graduation ceremonies.



View of typical classroom wings at Cubberley High School, Palo Alto, California.

Construction: Construction for the typical classrooms and administration is wood frame. The Cafetorium, Library, Gymnasium and Shops are wood and steel frame. The use of structural plywood, is employed for roof diaphragms and lateral shear panels to resist seismic forces. Exterior walls are finished with integrally colored cement plaster which was selected for its durability and low maintenance cost. Surfacing on the composition roofing is gravel.

Mechanical: Heating system for typical Classrooms, Library, Administration and Shower Rooms is hot water radiant floor panel. Cafetorium is heated with warm air with fresh air intake through heat exchanger, delivered through high grilles into room at one end and evacuated at other end. Shops, Gymnasium are heated with ceiling hung, gas-fired unit heaters.

Artificial Illumination: Lighting for typical classrooms is provided by concentric ring fixtures with 500W incandescent silver bowl lamps. The Cafetorium has recessed 500W incandescent fixtures. The Library and Shop have low brightness Slimline fixtures.

Additional information concerning the Cubberley High School may be obtained by writing to the school district office or to Clark & Stromquist, 321 Channing Avenue, Palo Alto, California.

HILLSDALE HIGH SCHOOL - San Mateo (California) Union High School District

Hillsdale High School, fourth high school in the San Mateo Union High School District, was planned as a complete school for an enrollment of 1750 students. The thirty-five acre site extending along the south side of 31st Avenue from the Alameda de las Pulgas on the east to del Monte Street on the west, slopes toward the Bay to the east. The compact building group encloses approximately five and one-third acres, leaving the remaining 29-2/3 acres for athletic and recreation-

al use, and for off-street parking.

The building group is one story high throughout. The elements vary in height according to use and are disposed about a central court with the elements increasing in height as the site slopes down from west to east. Academic areas lie to the west, Shops to the south, Cafeteria and Little Theater to the north, and Auditorium and Gymnasia to the east.

Framed in steel and decked in steel, divided by movable partitions, lighted by rooflights, heated and cooled by mechanical ventilation, interconnected by ramps, Hillsdale High School is the reflection of change and development in secondary education.

Basic Design Premise

Two years of preliminary planning led progressively toward adaptability as the major requirement. The Board of Trustees, Superintendent and Faculty, the Educational Consultants of the School of Education, Stanford University, the Architects and Engineers, could not fix upon one program for secondary education to which a conventional building could be designed. Current practices, trends, predictions, led in many directions. Assurance of any single course was lacking. The excitement of creative, developing education demanded that the building exceed convention.

The Basic Design Premise of the Hillsdale High School therefore is that it shelter with grace the known program of the present, the unknown programs of the future, and the change which is the sure aspect of secondary education.

Stemming from the Basic Design Premise were certain guides to solution.

First. The conviction that a known program would not long remain unchanged favored not the tightly-planned, minimum-area type building where one area interlocks with others, but rather a building where rooms and groups of rooms relate to one another with order and consistency.

A modular plan was therefore adopted. Modules of structure, of natural and artificial illumination, of heating and ventilation, and of room division and arrangement, were carefully related each to the others, to permit unlimited plan possibilities.

Second. The anticipated changes of program require changes in room size and in the relation of one room to another.

Partitions were therefore made non-bearing throughout. Areas where change was most likely, such as English, language, social science, mathematics, science, homemaking, business education, library and administration, were given movable partitions, completely reusable and subject to repeated change.

To permit the relocation of corridors and rooms, opening up or closing off of views, and to permit adding to the structure, an exterior wall system was designed where opaque, insulated panels, translucent or clear glass panels, and glazed or solid doors could be interchanged.

Third. Movable partitions used most advantageously would permit rearrangement in any direction without respect to distance from windows, arrangement of heating units or location of electrical fixtures.

To make room arrangement independent of window walls, an overhead system of natural daylighting was adopted. The alternative of completely artificial illumination was rejected as a less pleasant, more isolating, solution. Completely mechanical ventilation was then adopted with provision both for heating and for cooling. Artificial illumination and heating modules were combined with the natural daylighting

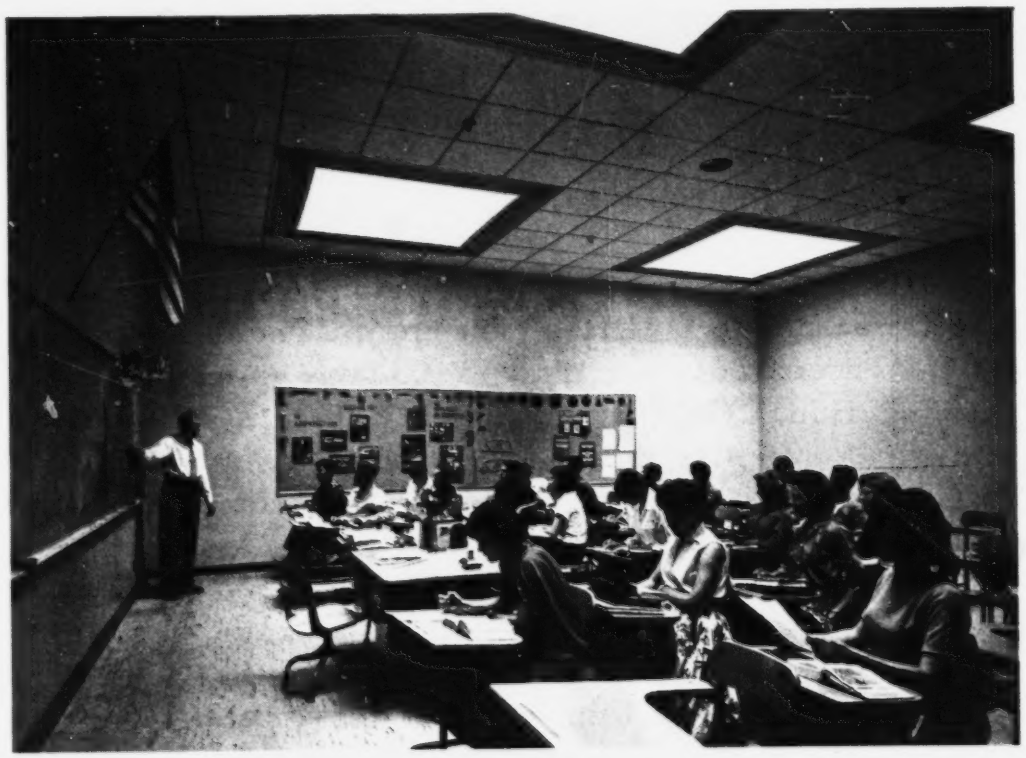
module to form, as it were, one modular utility unit fitting within the structural module.

Further steps proceeded, always with close attention to the needs of the initial program, as well as the future programs. Economy was always in mind in the designing. Where desirable features extended to the limit would yield diminishing advantage, a rational limit was sought. The modular control of heating and cooling for example would have perhaps doubled the cost of distribution system if it had been set upon a 14' x 14' module instead of the efficient and acceptable 28' x 28' module. Artificial illumination on the other hand would cost little if any more on the smaller module and was adjusted thereto.

Rooflights. Modular units are used, fabricated in one 6' x 6' piece. An aluminum grid holds glass blocks, sealed with lightweight mortar and tar and sulphur compound. The blocks themselves are prismatic blocks special to the purpose. Desirable light is transmitted through the prisms, diffused by the glass fiber filter and distributed by the lower surface of the block. Desirable light is determined as north light and low angle south light. All other light is determined undesirable and is rejected by the carefully adjusted prism surfaces. The result is an even illumination with compensation for low outside brightness coincidental with low angle sun, and sunless days. The prism also results in the elimination of mid-day glare and heat.

Ventilation. At the four corners of each 6' x 6' rooflight well there is a 12" x 12" grill. From these grills comes a continuous supply of fresh outside air. This air may come entirely from ducts carrying heated fresh air, entirely from ducts carrying cool, unheated, fresh air, or a mixture of the two. The balance is controlled by thermostats, one for each 28' x 28' bay. Control is automatic but a check on room temperature is available from a panel in the administration for every thermostat location in the building.

Artificial Illumination. On four sides of every rooflight well, abutting the ventilation grills at the four corners, are three-tube, egg-crated, fluorescent fixtures. Intensity of illumination can be adjusted by lamping with one, two, or three tubes per fixture, and thereby may be provided restful general lighting,



Homemaking room arrangement at Hillsdale. (photo by Sturtevant)

more intense classroom lighting, or high level illumination for special, difficult seeing tasks. Use of the fixtures is minimized, however, by the even, compensated, light from the roof lights. All switches for these fixtures are located above the ceiling and controlled remotely from any desired location. Low volt-

age control wiring does not require conduit and can be re-strung to new locations as partitions change.

Public Address System. The Public Address System wiring is also above the ceiling. Speakers are housed in sound boxes set into the ceiling panels. Location may be easily changed and new speakers added.

Other Electrical Service. In addition to the electrical distribution above the ceiling, there is also

Typical interior classroom at Hillsdale. (photo by Sturtevant)

a complete under floor conduit system. Each 14' x 14' module has four floor boxes which it can tap for power, making new outlets, or outlets in re-arranged partitions each to connect. The asphalt tile is laid over the boxes, and their location is marked by a single tile of solid color placed over each box.

Plumbing Connections. To permit new and changed locations for plumbing fixtures, water supply is carried overhead and may be brought down at any column. Waste lines are stubbed out at alternate columns in each direction and capped under the asphalt tile; corresponding vents are capped above the ceiling. Thus, all classrooms may be equipped with sinks if desired. Gas can be brought down at any column; vents for ranges, etc. can be up along columns as in the homemaking rooms.

Ceiling System. Because the space between ceiling and roof deck is used for utility distribution of many types, a grid system with removable panels is used for the ceiling. Face of panels is fiber board of the desired absorption value, backed with gypsum board both for fire proofness and to prevent transmission of sound into and therefore through the utility space. Access to any utility is available by removing appropriate panels.

Movable Partitions. Metal panels with baked enamel finish spanning from floor to ceiling may be rearranged as desired. Interchangeable panels either solid or with various types of glazing, or with doors, are provided in a limited number of widths permitting an unlimited number of room arrangements. A special provision makes it possible to install the partitions at angles. This was desirable in order to improve acoustics and to avoid monotonous repetition. The corridor walls, for example, are zig-zag in plan. This relieves the reverberation tendency in adjoining rooms, avoids the intermidable converging perspectives of the usual long corridor, allows doors to be placed in wider points to reduce corridor obstruction, and creates natural conversational areas for the students.

Relation to Outdoors. While the projection of the Basic Design Premise has resulted in some inter-

ior rooms, they are all day-lighted. More rooms have a view than not. It is anticipated that a student will spend less than a third of his time in viewless rooms. As he moves from class he will, by design, encounter vistas to the surrounding countryside and into landscaped areas; where he will be encouraged to gather with other students.

Swimming Pool. The swimming pool is located within the central court as a result of wind tunnel tests which favored such a location as best possible for an outdoor pool. Consciously drawn away from the blank-wall, high fence, type of enclosure the pool is a center of interest and an integral part of the landscaping. Bleachers are provided to encourage casual viewing of pool activities.

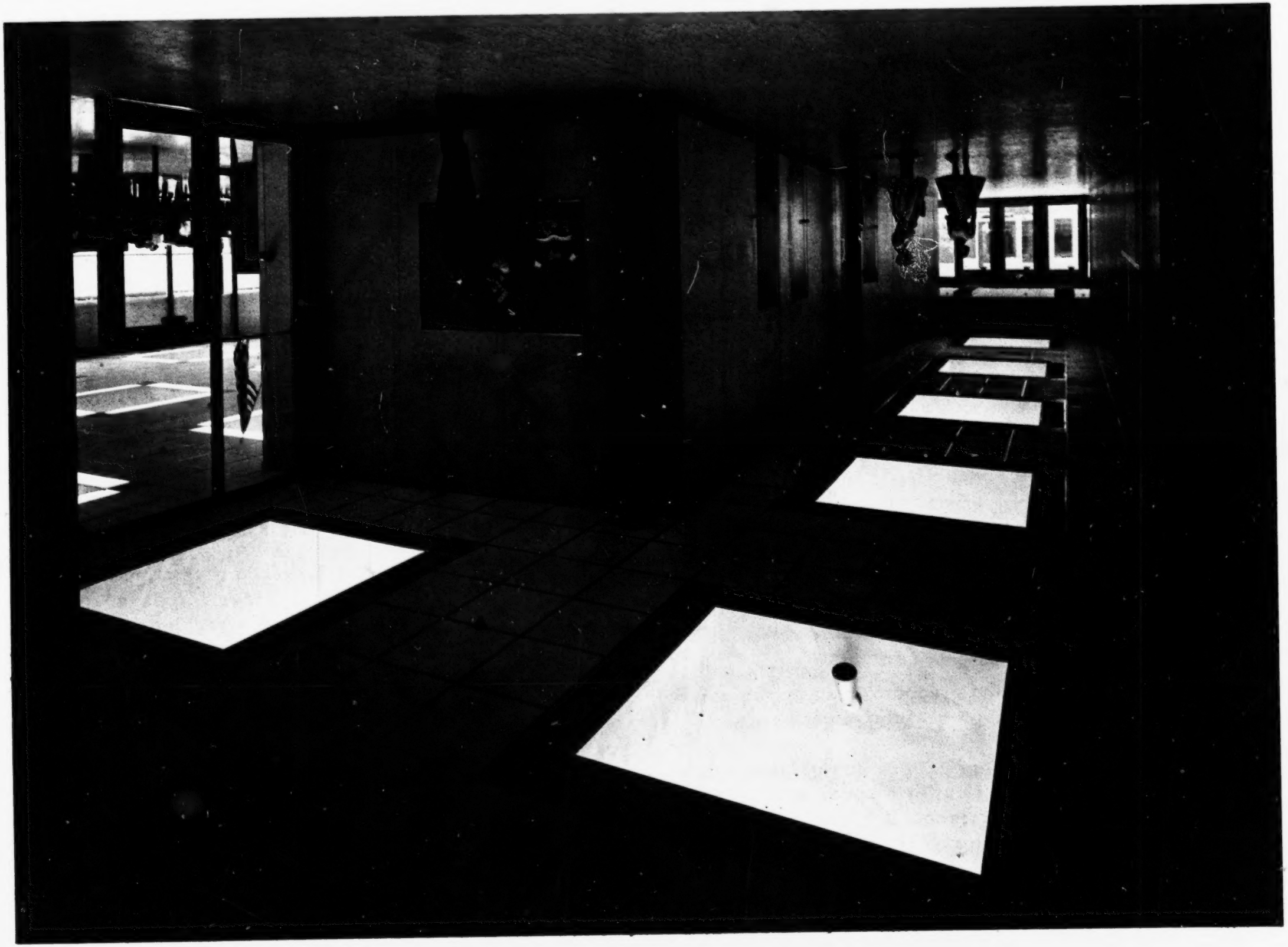
Auditorium and Little Theater. These valuable educational facilities have been designed with such economy that their worth will be unquestioned. Each of these areas is essentially one room with the sloping floor scooped from the earth forming the platform, or stage, and providing walkways completely around the room at stage level. Lighting and curtains can be hung in great variation from the ceiling of the platform. Platform and audience can be made very much an entity for concerts, pageants, and experimental drama, or can be separated by curtains for conventional relationships. The choice between no auditorium and the costly theater has been avoided. These are instructional areas, sufficient to instructional purposes, and less costly than many other instructional areas.

Cafeteria. It is assumed that the cafeteria is also an instructional area. As learning the customs of society can be a pleasant natural experience if properly nurtured, a system of cafeteria service is offered which encourages the maximum use of its facilities. An alcove area is provided for luncheon meetings of student organizations. All food is dispensed within the cafeteria. Four lines are provided. These may be any combination of hot or cold lines. The cold lines can serve the purpose of the "Snack Bar." But while it is made possible for a student to pick up a snack and dash out, he is exposed to the prospect of hot nutritive food at adjoining lines, and to a healthful balanced diet of cold food in his own line. He is also given a glimpse of a pleasant social activity which will, it is hoped, look hospitable.

Fire Protection. Special research was conducted in cooperation with the State Fire Marshall's Office to make Hillsdale High School as nearly a fire-safe building as possible, and at the same time to avoid fire protection that was costly and restrictive to good planning. The result is a completely incombustible, fire-sprinklered building. Advantage is taken of sprinklering to eliminate all plastering of steel members except in the largest assembly areas, to permit corridor construction to be identical with classroom construction, to increase the permissible area of structure, and to reduce the need for fire walls. The considerable cost of the fire-sprinklering was more than regained by savings it made possible in construction. The District has determined that savings in insurance rates will pay for the system in very few years.

Cost Analysis

It is the intent of this analysis to state costs clearly and accurately and to leave no question about what is included in each cost quoted. No claim is made that Hillsdale High School is the cheapest high school that could be built and the costs are not selected to enhance favorable costs. The costs do indicate, however, that costs were low compared with much current school construction and that any extra cost for movable part-



itions, prismatic glass-block roof-lights, mechanical ventilation, etc. was more than offset by the savings resulting from a compact plan, repetitive structure and consistent detailing. The following is a tabulation of pertinent areas and costs with descriptions of items included.

Building Area: (Includes all enclosed portions of building at full area and all open, roofed areas at one-half full area.)	225,779 sq. ft.
Building Cost: Total general contract (includes the following equipment in the contract which is customarily purchased by separate contracts: movable cabinets, laboratory furniture, movable kitchen equipment and appliances, lockers.)	$3,442,678.00
Grading Contract:	$ 39,000.00
Site Utilities: (Includes separate water mains for sprinkler system and domestic system, sanitary lines, storm sewer on-site and off-site with all catch basins.)	$ 96,600.00
Pools and Site Work: (Include all site improvement outside of building lines and swimming and diving pools.)	$ 221,294.95
Total of above contracts:	$3,779,573.17

Additional data concerning the Hillsdale High School may be obtained by writing to the office of the San Mateo Union High School District, San Mateo, California, or to John Lyon Reid and Partners, Architects and Engineers, 1069 Market Street, San Francisco, California.

SUNNYVALE HIGH SCHOOL - Fremont Union High School District, Sunnyvale, California

The Sunnyvale High School, located in a rapidly expanding and highly industrialized area, is one of two existing high schools in the Fremont Union High School District which has a third high school plant in the design stage.

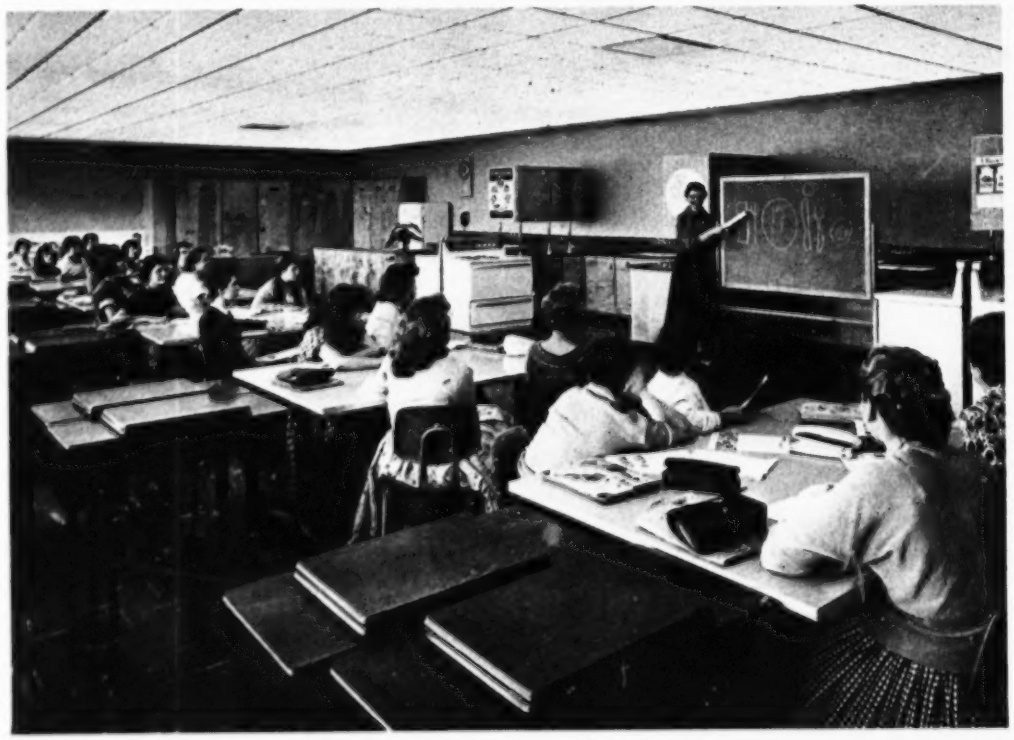
This high school was designed to reflect its location and to accommodate one thousand five hundred students.

View of classes changing at Sunnyvale High School. (photo by Cal-Pictures)

In order to provide satisfactory physical surroundings, careful consideration was given to the type of ventilation, lighting, color, equipment, and landscaping selected for the project.

All classrooms and study rooms are heated by means of unit ventilators which provide a regulated uniform change of tempered air consistent with the pupil load.

Uniform, shadowless lighting is accomplished by the use of "luminous ceilings". The use of this type of lighting permits any desired variation of seating arrangements under a constant uniform light. The glare factor between work levels and ceiling is reduced to a ratio of one to two and one-half, the work level having a uniform lighting of fifty footcandles.



Typical classroom with over-all luminous ceiling. (photo by Cal-Pictures)

Inasmuch as the student body comes from an industrialized urban area, and the school is operated on a "closed campus" program, considerable thought has been given to the furnishing of an attractive campus providing an abundance of recreational areas; a rally court for student body meetings as well as a student congregating area; tennis courts, basketball courts, baseball diamond, track, football field, a diving pool, swimming pool and training pool. These pools will be used by the Community during the summer vacation, in conjunction with their use of the adjacent City Park.

To insure a pleasant campus environment, the complete site is in the process of being landscaped by Mr. Gil Rovianek, Landscape Architect, who is the Landscape Architect for the adjacent City Park. Although the end results are not, at present, apparent, due to the recent planting, the future growth of trees, shrubbery, and flower beds together with the grassed areas will give the plan an increasing planned garden surrounding as the years pass by.

Additional data concerning the Sunnyvale High School may be obtained by writing to the school district office or to Masten, Hurd and Abrams, Architects Associated, 526 Powell Street, San Francisco, California.

FRANK C. HAVENS SCHOOL - Piedmont (California) Unified School District

This school building, which is an addition, and replacement for the main part of an existing elementary school in a residential area in California's Bay Region, has 12 classrooms with library, administration and dining room. It is designed for Kindergarten and first to sixth grades.

Its main features include the extended bi-lateral daylighting and the luminous ceiling, resulting in more effective double loaded corridors, the ramps connecting the three levels giving an impression of oneness to the school, the scale being one for children.

Existing School and Site: The site contained an old 1909 building which was totally inadequate for a modern educational program, and which was structurally unsound insofar as the California earthquake laws are concerned. In addition, there was a five-classroom wing, constructed during the 1930's, which was structurally sound, and which was to be retained for classroom use. An assembly unit, facing on Highland Avenue, was to continue to serve. Further expansion of the school plant, beyond this new structure is not contemplated.

The Problem. To provide new space for the kindergarten and first six grades in buildings scaled for children and designed in appearance for good integration with the surrounding residential neighborhood. It was necessary to continue to use the old classroom building during construction. Consequently, new construction had to be fitted into the space between the old building and Oakland Avenue. Economy in design was a factor.

The Site. The site, with buildings and playground areas, is a great deal smaller than desirable

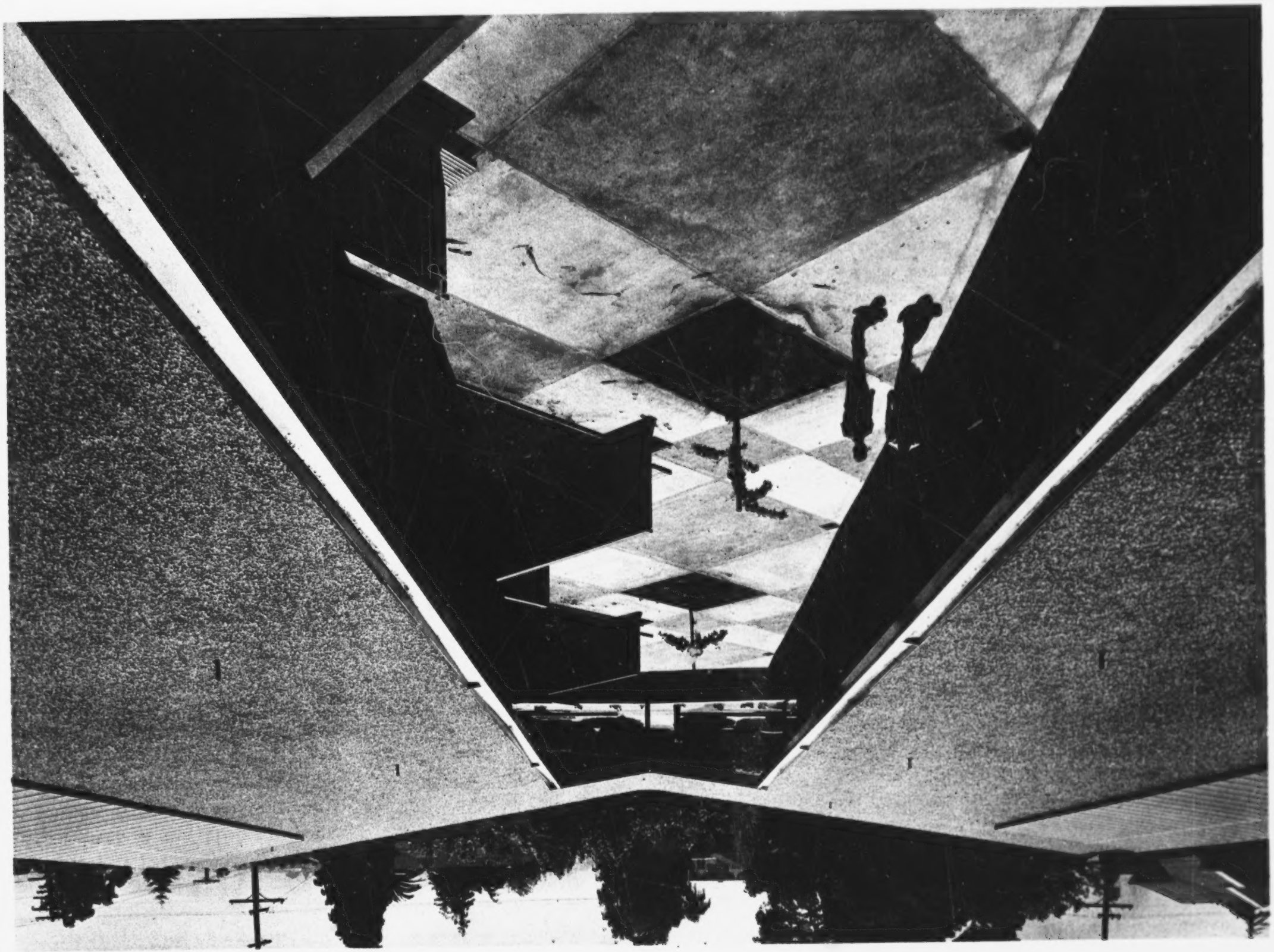
View of double-loaded corridor at Frank C. Havens School, Piedmont, California.(photo by Partridge)

in a new development where plenty of land is available. However, land limitations in an established residential area were a consideration. Located diagonally across the street are community recreational areas which could be utilized to augment school playground facilities.

Approach: A single story construction, generally deemed desirable for elementary schools, was thoroughly investigated for application to this situation. Results of this investigation indicated that single story construction with double loaded corridors would just barely fit the site. The problem became one of making the double loaded corridor work as efficiently as the best result achieved in single loaded corridors with bi-laterial lighting.

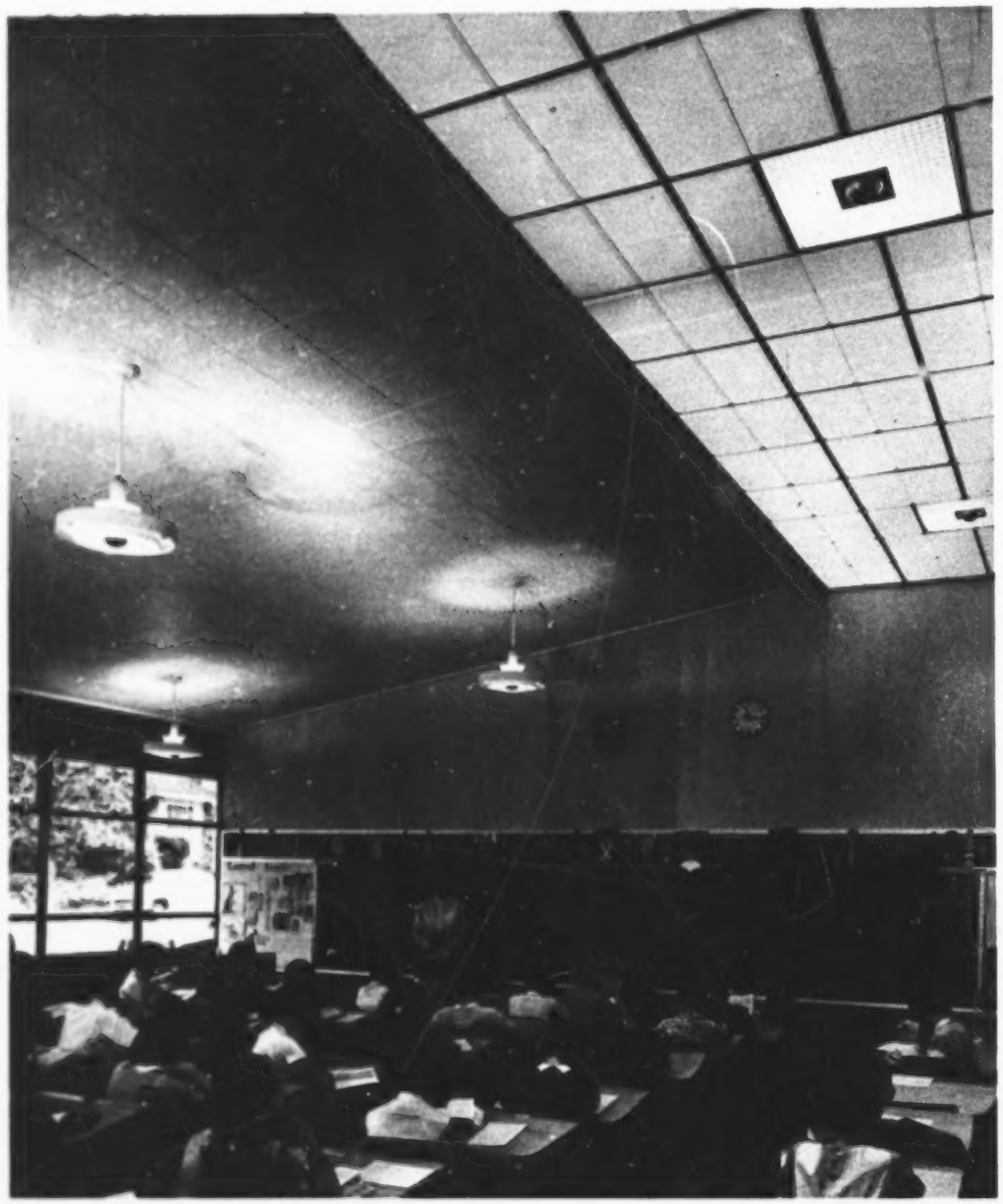
We had not encountered a satisfactory solution to this problem of the double loaded corridor. However, it seemed to us that by using a skylight and plastic ceiling which extended over the corridor and a portion of the classroom which would normally have little daylight, the problem of having a double loaded corridor work as efficiently as the single loaded corridor might be solved. Though designed in scale for children, the growth and dignity of the child was a consideration in the all-over scope. Choice of materials was to provide the warm character desirable in an elementary school.

The Solution: In the final solution, the 12 classrooms were arranged along 2 double loaded corridors. Construction methods were simple, with sloping roof, large gables, and redwood and buff concrete block exteriors. The large gables were extended along the Bonita Street side to provide protection over the exterior walkways, rather than building a separate and non-harmonious cover for the walkway. Gables were joined together in a "V" at the open court between the two classroom wings, and the ceiling of the walk-



way cover is T & G redwood.

Although the plant is constructed on three levels, the sloping roofs and large gables contribute to an over-all low feeling--a feeling that the plant is an essential part of the sloping earth. The various levels have been resolved by the use of ramps, giving an impression of wholeness, which is furthered by the manner in which the pink cast of the roof blends in with the redwood and brick siding.



Illumination: Over the corridors and extending over one-third of the classrooms are the continuous skylight and the luminous plastic ceiling, providing an abundance of soft, natural light which flows through the middle of the building, furnishing efficient and restful seeing environment. "Sky-like" fixtures are fitted into the luminous ceiling, while "Educator" fixtures are used in the rest of the ceiling area.

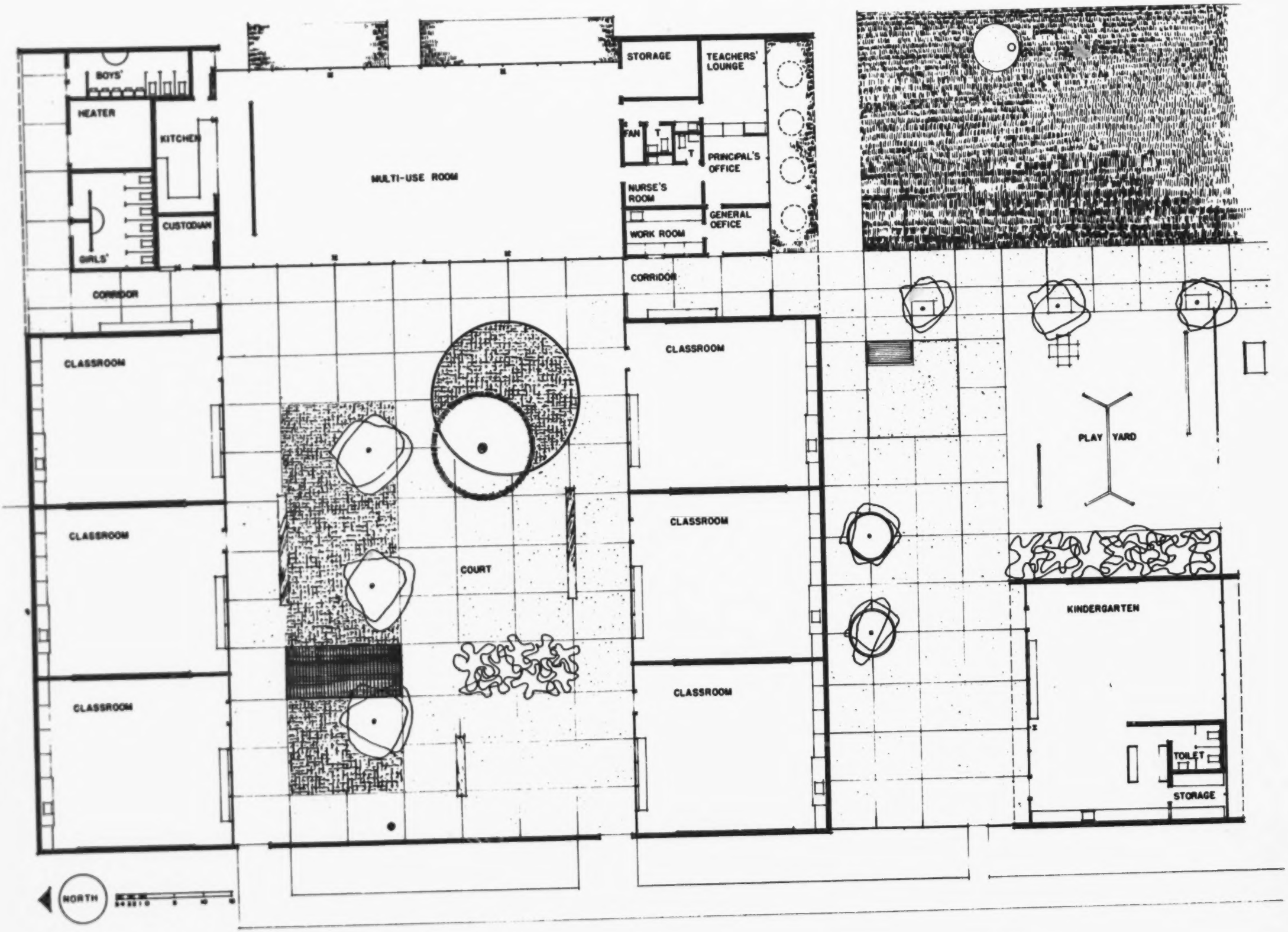
Additional information concerning the Frank C. Havens School may be obtained by writing to the school district office or to John Carl Warnecke, 111 New Montgomery Street, San Francisco, California.

OLYMPIA PRIMARY SCHOOL - Jefferson Elementary School District, Daly City, California

This school represents a new concept in educational type designs which the architect had completed up to that time in the district. The results of the accelerated school construction program in this district revealed that the basic concepts were not applicable. It became necessary, therefore, that the architect and educators re-evaluate their considerations in terms of the new problems at hand.

The Olympia Primary School, which includes kindergarten, first, second and third grades, was conceived to function as a home-school unit for summer recreation facilities and provide for community activities.

The Problem: Since the school is located in a densely populated urban area and situated near the Pacific Ocean which exposes it to prevailing winds and


BOYS'
HEATER
KITCHEN
GIRLS'
CUSTODIAN
CORRIDOR
MULTI-USE ROOM
STORAGE
TEACHERS' LOUNGE
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T
PRINCIPAL'S OFFICE
NURSE'S ROOM
GENERAL OEFICE
WORK ROOM
CORRIDOR
CLASSROOM
CLASSROOM
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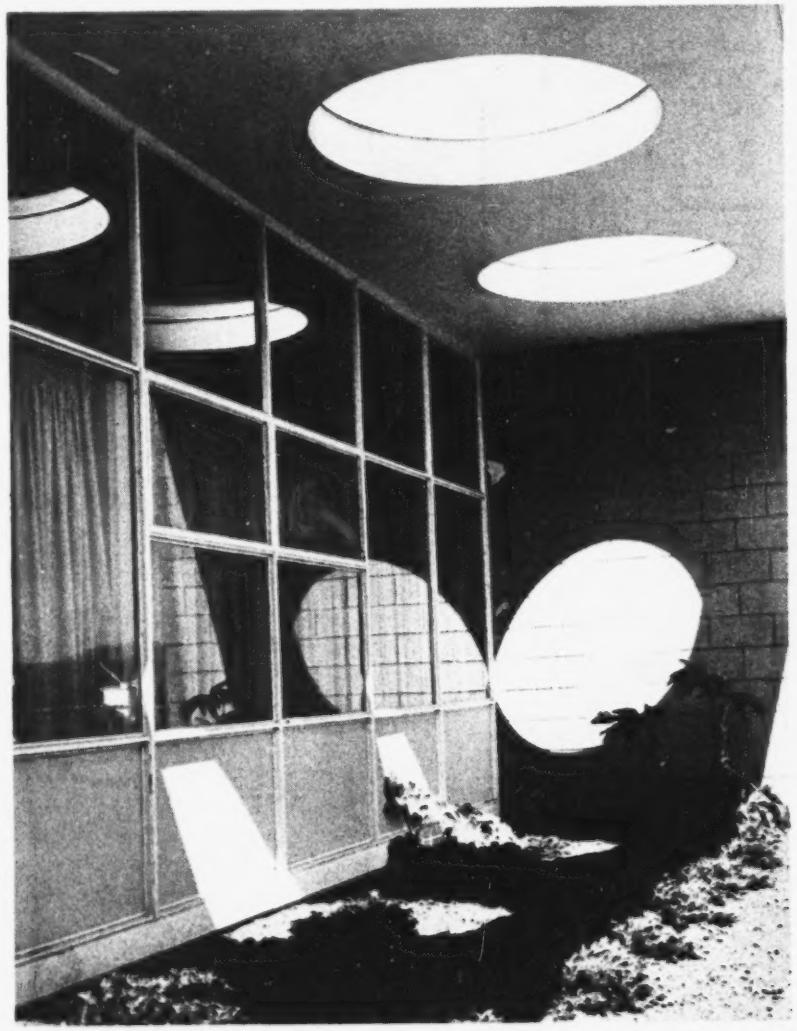
CLASSROOM
CLASSROOM
COURT
PLAY YARD
KINDERGARTEN
TOILET
STORAGE
NORTH

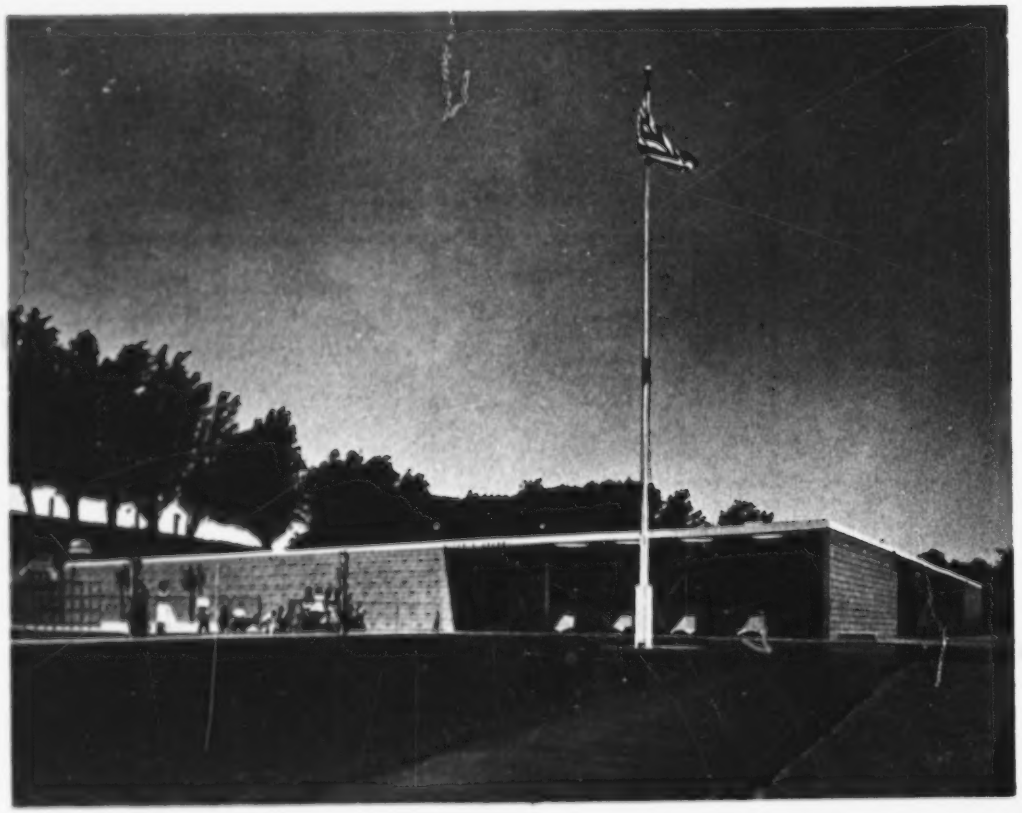
fog, the problems of protection against vandalism and maintenance became important factors in its design.

Former experiences with other school projects in the area indicated that while a very serious effort had been made to provide adequate natural illumination in these buildings, electric lights were burning almost continuously, seemingly because this artificial illumination seemed to create a more pleasing environment. Maintenance of wood and stucco type buildings has also been a considerable problem to this district.

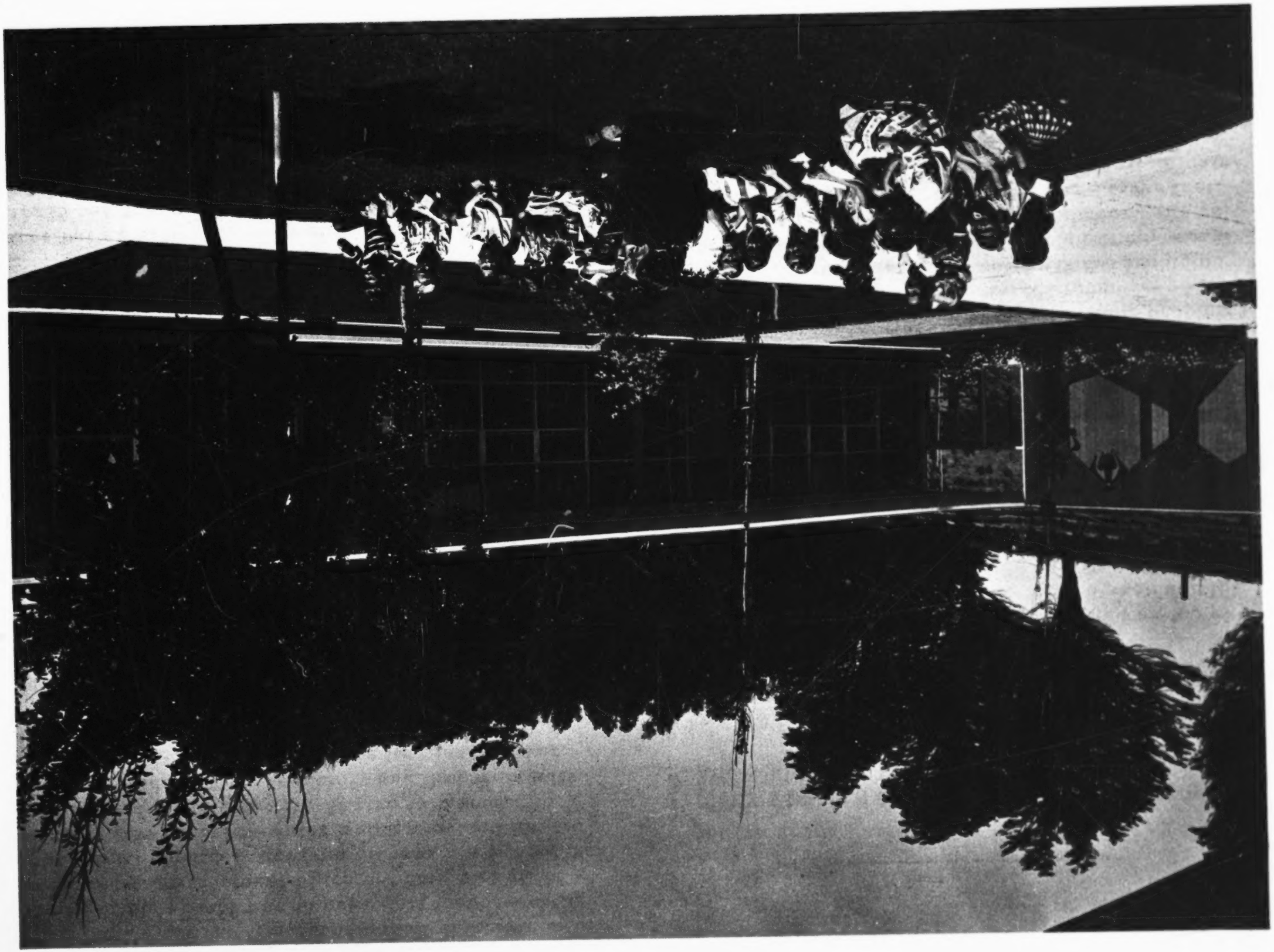
The Solution: The Olympia School was, therefore, constructed with a reinforced concrete roof employing the "lift slab method." Exterior walls were constructed of reinforced concrete blocks with a textured pattern and painted a pleasing color to create a pleasant exterior.

The classrooms are designed to face a completely enclosed, pleasantly landscaped playcourt which is easily maintained. They are equipped with "Luminous" ceilings which maintain a uniform brightness of 65 foot-candles. The large window in each room which faces the court has colored glass inserts to relieve the monotony of all the large expanse of clear glass.





The school is finished in natural woods. Bright colors are introduced in many of the wall cabinets, panels, dividing walls and doors.



The Objective: The fundamental objective in the concept of the school was to create an ideal teaching and learning environment which not only met all of the material considerations which have been described but made this school a center which provided for the enjoyment of those using it. It also is intended to stimulate pride in the community and that the adults as well as the children may share its pleasure and attraction.

The architect, in his desire to emphasize the importance of the arts in education, included a colorful educational mural, at his own expense, on a large redwood wind screen at the west end of the central court. The school children became so intrigued with the mural that, as a result of their enthusiasm, they made colored reproductions of many of its features. The architect and the school officials have been observing and evaluating the experiences of those who occupy this school and are now giving further consideration of the incorporation of many of these qualities in their new schools.

Cost of Building	$ 176,950.00
Site Work	41,100.00
Total Cost of Project	$ 218,050.00

The cost of this project, including all these features but excluding the cost of site work, amounted to $12.75 per square foot. This cost is comparable to or less than some of the more conventional schools in the school district.

Additional information concerning the Olympia Primary School may be obtained by writing to the school district or to Mario J. Ciampi, 425 Bush Street, San Francisco, California.

SYDNEY ELEMENTARY SCHOOL - Castro Valley (California) School District

The Sydney Elementary School, constructed in 1955-56, consists of seven standard classrooms, a kindergarten, administration unit, multi-purpose room and kitchen.

The Problem: The school is located on top of a windy hill which was cut down to form a shelf for the school and playfield. This windy condition influenced the site planning and was a factor in the selection of a double loaded corridor classroom scheme. The hilltop location would also tend to make a building look stilted so a low silhouette against the skyline was felt desirable.

The Solution: Previous design experience points up the difficulties of a satisfactory solution to a bilateral lighting system for a double loaded corridor. The slotted roof over the corridor is a continuous source of roofing leaks and window cleaning problems and complicates the construction framing.

Top lighting seemed to solve all the problems of adequate lighting regardless of orientation, simplified construction framing over the corridor, and reduced the height of the classrooms some three feet.

Savings: The cost of a top lighted system using Solartron, a sun control device, was compared to that of a typical bilateral lighted classroom.

The following comparisons were drawn from actual construction costs of the Sydney School (however, only those items directly related to the problem are presented):

Typical Classroom

Aluminum windows	285 sq. ft. @ $3.55	$1,000.00
Interior louvers	280 sq. ft. @ $1.00	280.00
Drapes	285 sq. ft. @ $ .60	170.00
		$1,450.00

Top Lighted Classroom

Skylight	196 sq. ft. @ $2.20	$ 432.00
Solartron	196 sq. ft. @ $5.00	980.00
Window	96 sq. ft. @ $3.55	340.00
Drapes	96 sq. ft. @ $ .60	58.00
		$1,810.00

Savings

Cubage saved @ 3' of wall:
2.5' x 124' = 310 sq. ft. of wall @ $1.10 = 340.00
$1,470.00

Total Cost: Statistical data for the school is as follows:

New building construction cost - - - - -	$ 209,500
Utilities - - - - - - - - - - - - - - - - -	4,800
On Site Development - - - - - - - - - -	18,200
Off Site Development - - - - - - - - - -	1,150
Total Cost - - - - - - - - - - - - - - - -	$ 233,650

Total Area	14,594 square feet
Unit Cost	$14.36 per sq. ft. or 1.1% above normal allowable cost, but 1.9% below the 3% tolerance approved by the State Allocation Board.
Heating System	Central hot water system with unit heaters.
Lighting	Concentric ring incandescent.
Construction	Precast concrete bents and wood frame. Brick and resawn redwood exterior finish. Plywood interior finish.

Additional information concerning the Sydney Elementary School may be obtained by writing to the school district or to Lillis & Smith, 912 Tennessee Street, Vallejo, California.

VISTA MAR ELEMENTARY SCHOOL (in progress)
Jefferson Elementary School District, Daly City, California

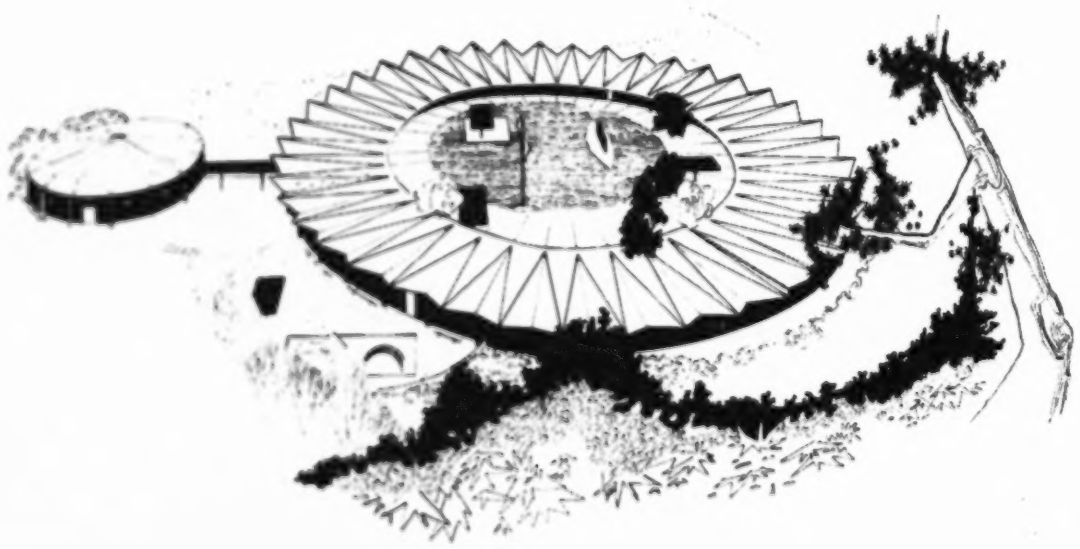
Site: The seven acre site is located in densely populated Daly City, California, near the Pacific Ocean, an extremely foggy section of the San Francisco Bay Area. The prevailing winds are always cold and damp. The site is quite steep, wedge-shaped and has a limited access--i.e., from one street only. No provisions for expansion are possible on this site, which has a net usable area of approximately 4-1/2 acres.

The Problem: To construct a 12 classroom, 2 kindergarten elementary school with special activities room, administrative unit and adjunct facilities, and a multi-use room unit to serve as a community center. The problems of vandalism and maintenance are serious factors to be considered. The project is to be con-

structed under the California State Aid Program so there are but limited funds available.

Proposed Solution: To provide an educational environment for the children of the community which would avoid the dull repetitious quality of standardization. The site will be graded so that the actual building will be placed in a bowl approximately 60 feet below the upper street level. The view down into the school was considered most important. The site, due to the nature of the grading problem, justified a circular plan. This concept was considered desirable educationally since it was the intention of the architect and school officials to promote the most charming and attractive setting for the children. The controlled central garden can be easily maintained and controlled so as to provide a pleasant outlook for all classrooms and a sheltered area for outdoor activities.

The Multi-Use Room unit is also circular in form to relate to the larger classroom unit. The unit is designed to be used for drama, music, games and for dining. This building is also designed to provide



facilities for an adult community and recreation center. No provisions of this kind were provided by the builders. It was also considered important that since this school building was to be a cultural center for the community a circular concept of forms would be a relief against the monotonous repetition of rectangular buildings in the surrounding area.

Construction: The buildings will be constructed of reinforced concrete frame and roof, brick and concrete block walls, and steel sash with clear and colored glass. It will have a composition roof. Small shelters of light steel and corrugated decking will be painted in brilliant colors. The classroom building will be heated with radiant heating. Multi-use room building will have forced ventilation. All partitions are non-structural and may be easily moved if required.

The roof structure will consist of a precast, thin-shell, hipped-plate vault and erected in place over masonry walls and precast concrete rigid frames.

Acoustical plaster will be sprayed to the ceiling surfaces. Floors will be brushed cement, colored and waxed.

Additional information concerning the Vista Mar Elementary School may be obtained by writing to the school district or to Mario J. Ciampi, 425 Bush Street, San Francisco, California.

An Institute Extra

FUNCTION OF ESTHETICS

EMIL te GROEN, Cambridge Tile Manufacturing Company, Redwood City, California;
as told to:
GLENDON NIMNICHT, Intern, General School Administration, School of Education, Stanford University

When the expression "functional design in school buildings" is used, one thinks of the school buildings that are being built to serve the educational needs of

Use of tile on exterior of New Bern High School building was effectively demonstrated by the architects, Stephens and Stephens, New Bern, North Carolina.(photo by Cable Studio)

children. In designing these functional buildings with their clean, clear lines, the attention has been focused on obtaining correct lighting, the right size and shape of classrooms, wise use of space, and the facilities necessary for an expanding curriculum.

One of the criticisms that is often heard in regard to functional buildings is the lack of attention given to esthetics. Some people feel that functional buildings are sterile and cold. This is due in part to a difference in artistic tastes; however, to some extent the criticism is justified. Certainly a large number of architects have been able to design functional buildings that have pleasing designs, but it is true that often esthetical considerations have been sacrificed to

Tile makes a permanent decorative wainscot and floor for this washroom in Bath (Maine) Junior High School designed by Alonzo J. Harriman, Inc., Architect. (photo by Douglas Photo Shop, Bath, Maine)

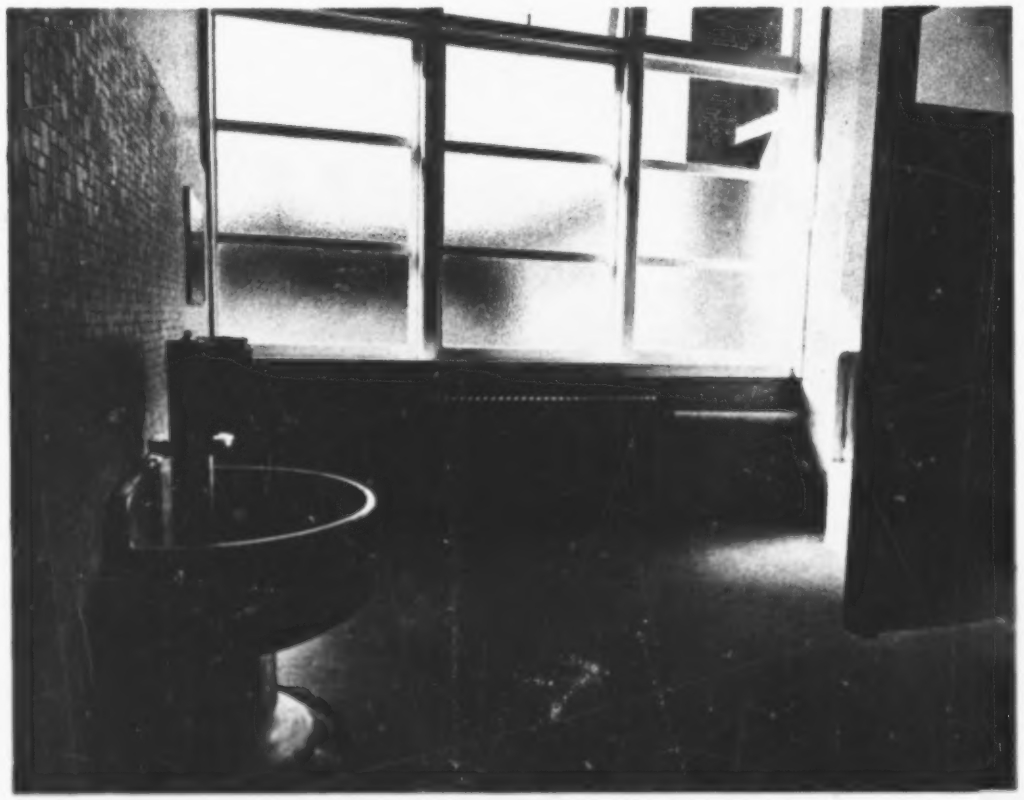
achieve functionalism and economy.

Perhaps beauty for beauty's sake is not functional, but there are functional benefits to be derived by enhancing the appearance of school buildings. Individual reactions created by the appearance of a building are important. Most of these reactions are psychological and therefore difficult to describe. For example, a dark, oak-paneled dining room elicits one response while a brightly lighted, stainless steel lunchroom elicits another. Differences in the total school environment due to the appearance of the buildings manifest themselves in the children's behavior.

One superintendent has pointed out the function of esthetics in a school building in two ways. He says that as the appearance of a building is improved, the damage due to vandalism decreases. To illustrate this fact, window breakage in his school was reduced by one-half as a direct result of landscaping improvements. His second point was that an attractive building has educational value in improving the children's appreciation for the beautiful and the artistic.

Educators speak of the role of education as not merely a task of transmitting culture from one generation to the next but also the dynamic process of improving that culture. It would hold, then, that it is also important in the type of buildings that are designed and built for school use. If the school plant is to have the desired effect upon a community, it must

Max Spivak created this Drum Majorette design and many other over-all patterns exclusively for Cambridge Tile Manufacturing Company. (photo by Lodder, Cincinnati)



Tile makes a permanent decorative wainscot and floor for this washroom in Bath (Maine) Junior High School designed by Alonzo J. Harriman, Inc., Architect. (photo by Douglas Photo Shop, Bath, Maine)

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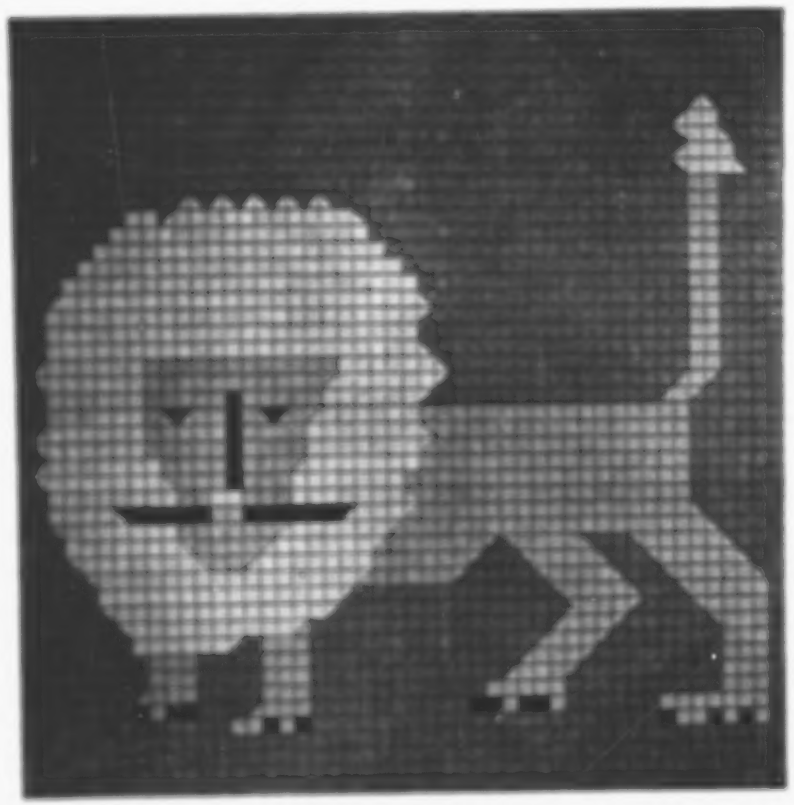
be of value as an esthetic improvement as well as a functional school.

My purpose here is not to become involved in a detailed discussion of design of school buildings but merely to present a material which has been used quite effectively to beautify or decorate school buildings inside and out. The material I am referring to is tile. This material offers a means of breaking the solid, blank effect of a wall or accentuating a feature of design. The tile industry in general has made improvements in the manufacture and color qualities of tile, and the Cambridge Tile Manufacturing Company has developed a new process to speed installation. Through these improvements tile has become a decorative material which is permanent, practical and economical. As a result, tile is being used in increasingly greater quantities in our public schools.



Various animal or bird motifs are among the Max Spivak Designs executed in colored tile which may be used for permanent or interchangeable decorative panels in school rooms. (photo by Lodder, Cincinnati)

Another Max Spivak Design executed in Sun - Tile exclusively for Cambridge Tile Manufacturing Company. (photo by Lodder, Cincinnati)

Since the time of the Romans, who used tile in building their baths, the utility and durability of this material has been well known. To a certain degree, the decorative qualities of tile have also been recognized but were generally considered secondary to its durability. In the functional sense, it has been common practice to use tile in areas that required a durable material, e.g., one that was impervious to water. Thus tile has been used in toilet rooms, halls, and other areas of schools subject to moisture and abuse.

The improvements in the tile itself are evident in the wide range of colors that are available for the architect to use in working out any desired pattern or effect that he wishes to create. Another improvement in tile has been in its surface texture. It is now

possible to obtain a bright, highly reflective glazed surface or the subdued surface of unglazed tile. A wider variety of sizes and shapes adds to its flexibility.

In the past, the high cost of labor has made the use of tile slightly more expensive initially than other wall surfacing materials. But improvements in installation have reduced this cost to the point where the economic block to a more liberal use of tile has been removed.

One of the improvements in installation--the "thin-setting-bed-method"-- involves the use of ceramic tile adhesives. In the installation of unglazed ceramic mosaic our company has combined the thin-setting-bed-method with a method of mounting the mosaic on webbing. This flexible webbing remains on the back of the tile and becomes a part of the binding which holds the patterned 12" x 24" panels of tile in place as it is installed.

A colored tile field affords an excellent background for a school name together with surface decor for planting boxes. Vincent G. Raney, Architect of San Francisco executed this treatment in San Jose, California.

Many architects are cognizant of the fact that these improvements in tile and its installation have been taking place. As a result, much greater use is being made of tile in all forms of its traditional uses as well, as an integral part of the design of the building to add beauty and color.

A variety of successful methods have been used to produce pleasing effects on the interior walls of the buildings. One of the simplest methods is to select three or four harmonizing shades of the same color and mix the various shades of mosaic tile so that a random scattering of the shades is formed. However, the architect may specify colors and the pattern of the design. An abstract pattern may be used to add color and beauty to an otherwise plain wall. The variety of uses depends only upon the imagination and creativity of the educational planners and the architects.

Through the efforts of educators and architects, the ornate schools with high pillars and lofty ceilings have been replaced with functional buildings designed to meet the educational needs of children. The environment of these schools can be improved to a greater degree by adding permanent beauty with minimum maintenance requirements. This can be accomplished through a more liberal use of tile as a decorative material.

part 5

improving the school environment
through

EDUCATIONAL TELEVISION

San Francisco Examiner

Scenes From The School Planning Laboratory

CLASSES

IN SCHOOL PLANNING, SURVEYS, AND COMMUNITY RELATIONS ARE HELD REGULARLY IN THE SCHOOL PLANNING LABORATORY'S COORDINATED CLASSROOM. VARIOUS DEMONSTRATION SET-UPS ARE ARRANGED TO ACQUAINT SCHOOL PEOPLE, BOARD MEMBERS, AND ARCHITECTS WITH PHYSICAL PROPERTIES OF THE CLASSROOM ENVIRONMENT.

No. 5

EXPERIMENTAL CLASSROOM TELEVISION PAVES THE WAY

RICHARD B. LEWIS, Professor of Education,
San Jose State College

There is widespread interest in the potential of television as a solution to the increasing problem in offering college and university education to rapidly increasing student population; lack of qualified and effective college teachers in proportion to the increase in enrollments, and the high cost of physical facilities for college classes, contribute greatly to the complications.

There are many current efforts being made in the United States to test the potential of television as a channel between expert teacher and college student. There is widespread hope that television can be applied to teaching many college subjects. Much has been done that indicates success can be expected when experienced educators, teachers, and television specialists cooperate to develop appropriate techniques for teaching by television. Though some traditional methodology and theory may have to be laid aside, methods for teaching by television do not do violence to currently accepted and demonstrated techniques for effective college instruction.

Among the now familiar devices of teaching that become an immediate necessity in television instruction are:

1. Continuous use of appropriate instructional aids, including graphs, pictures, models, exhibits, and motion pictures.
2. Effective demonstrations.
3. Skillfully planned experiences and activities for the student to explore after television instruction, either on his own or with the guidance of teaching assistants responsible to the major professor.
4. Carefully prepared evaluative techniques, both for the instructor's benefit, and to permit the student to explore his own development and learning.
5. Reading materials, selected to coordinate with television instruction, and with student guides and syllabi to direct independent study.

There is conviction and evidence that, with television,

1. Many students can observe an effectively taught lesson, often with closer visual attention than in a lecture hall.
2. Single lecture halls to accommodate an entire class are not necessary; television lessons can be observed anywhere on a campus or in a community.
3. Many things can be shown to a large class by television that cannot be shown adequately even to a small group; the TV microscope, long lenses, close-up camera techniques, and selective camera angles guide learning by television.
4. The general level of instruction is raised because television teaching requires effective selection and use of visual aids.
5. The instructor's time can be saved by concentrated television teaching, or content can be more thoroughly explored and reinforced by example if time

is not limited.

6. The expert instructor can reach many students; assistants, guided by the expert, can give personalized instruction to small student groups.

7. The cost of closed circuit or low power broadcasting television equipment, using Vidicon tube cameras, is relatively low when compared with the cost of buildings, laboratories, and lecture halls.

8. The cost of fully qualified professors to serve increasing enrollments, even if such instructors can be found, is far greater than extending the effectiveness of a skilled teacher to all potential students in any course; pay for such teachers may be some higher than for others, and assistants will be required, but, in the end, large groups of students can benefit from teaching by television.

Televising classroom activities — a demonstration.

At San Jose State College a pilot study of classroom observation was conducted for a period of six weeks, from February 13 through March 22, 1956, teaching credential candidates observed elementary and secondary school classrooms by CC-TV. Observations were supervised by instructors from the Division of Teacher Education.

Evaluations from the data compiled following the experiment indicates that students see more in a personal classroom situation after they have utilized television observation; television permits observation by large groups; students can see and discuss classroom procedure without interferring with the class; and there is opportunity for a college instructor to discuss teaching methods with his class as incidents occur in the classroom. The student's behavior seems little changed by the intrusion of the television cameras.

The television equipment at San Jose State College has been used in departments other than teacher education. In psychology, students have observed interviews between doctors and patients at Agnew State Hospital; projective testing techniques have been taught over television; and students have observed children at school and at play in the educational psychology course THE LEARNER.

In science, a television camera has been used with a microscope to permit an entire class to observe specimens on slides, to show small objects (etomology) to an entire class by enlarging the object sufficiently for definitive evaluation.

Television has served as regular studio equipment for college radio and television classes, and plans are being made to extend this use to include students in journalism and other courses.

San Francisco State College has received a $125,000 Ford Foundation grant to experiment with teaching several courses in general education over the

Bay Area Educational channel KQED in San Francisco. These courses start in the autumn of 1957.

A number of other schools in the state are experimenting with television instruction, and over 150 colleges, universities, and school districts throughout the United States are currently conducting or preparing to conduct experiments using television as an instructional tool.

Demonstrations presented in the program at Stanford have as their purpose the applications of instructional television to both college and public school teaching in a variety of subjects.

Selection of this demonstration was intended to show how television can present straight lecture, application of television for observation for teacher and student performances and the techniques of direct teaching by television.

By presenting this sampling of instructional television the audience may be able to see applications to a wide variety of instructional situations. It was a further intent of the program to show typical types of television equipment; the quality of picture reproduction possible; and some of the techniques of using television as a channel for teaching.

The program was to provide opportunity for the audience to obtain information on the problems and costs of television instruction in schools.

CLASSROOM T-V BREAK-THRU

ROBERT E. GREEN, Director of Education, Television, Dage Television Division of Thompson Products, Inc.

Most educators have long recognized the possibilities of television--its capacity for reaching many students simultaneously; the ease with which it can demonstrate tiny models; its potential for giving students a direct view of distant and even dangerous experiments.

In reality, however, television in schools has remained impractical because expense has been an obstacle to complete flexibility. With the advent of the vidicon camera television is no longer too expensive for schools to use. This is a new tube which makes possible sturdy, inexpensive cameras that give professional results with a minimum of maintenance and operating skill.

Instructional television is being used in universities and colleges throughout the United States and it has proved the following hypothesis:

Television can be as effective a means of edu-

A panel discussion is telecast to a school audience.

cation as conventional classroom instruction; television education improves the techniques and presentations of teachers. Television is merely a tool that is no better or worse than the individual who uses it.

Instructional television in the role of an educational tool is no longer a dream of the future but, rather, a proven means of imparting information in a classroom situation.

The ideal system for utilizing instructional television will be to have a receiver in almost every classroom, all interconnected so that each can receive the same program or a choice of programs either broadcast over the air or coming from any of a number of television originating rooms. For instructional television the classrooms are connected to the originating room or a control room by a coaxial cable costing approximately seven cents a foot, and two twisted pairs of shielded wires, one of which can be used for signaling. Electrical current can be taken from base plugs in classrooms as required.

When new construction is undertaken appropriate sized conduits should be installed. These conduits should be large enough for remote control circuits to run beside the coaxial and audio cables to the points where remote cameras are to be installed.

Technical aspects of Educational TV are not as complicated as they appear to the uninitiated.

INSTALLATION CRITERIA AND FACILITIES NEEDED FOR CLASSROOM T-V

OMAR E. LaHUE, Field Engineer,
Neely Enterprises

It is somewhat difficult to recommend general installation information because each educational institution will have somewhat different objectives. However, if these are not defined in the design stages, a certain amount of general planning can be done.

There are five basic categories for consideration. These are: physical facilities, cabling, lighting, receivers, and electrical requirements.

First, let's consider physical facilities. In the design of many school buildings, space is being allotted for a television studio or workshop. Even though the room may not initially be used to its full extent, it should be designed for the utmost flexibility. Such a studio would normally be used for the presentation of large programs and film and slide material.

A studio which is intended for the presentation

of scientific experiments and all types of lectures should be at least 20 feet by 25 feet. Preferably, it should be acoustically treated and the ceiling should be 10 feet to 15 feet. The higher ceiling is required in order to properly mount the necessary lighting equipment.

In addition to the main studio room, an adjacent area, a minimum size of 10 x 15 feet, should be allocated for film and slide equipment. Finally, if space is available, a third room would be used as a control room for both pictures and sound. This area should have a floor which is raised 2 to 3 feet above the level of the other two rooms, and adjoin them in such a way that the studio and film room will be visible through windows. The control room typically will require a minimum size of 10 x 6 feet. Floor ducts should be provided for running cables between the three rooms.

The second consideration is cabling. If a central studio is used, a cable pattern must be created which will allow the picture signal to be fed to each classroom.

There are several distribution systems, but with all of these, coaxial cable must be used. The coaxial cables that are typically used are RG-59/U, which is approximately 1/4 inch in diameter, and RG-11/U, which is approximately 3/8 inch in diameter. The larger cable is used where extremely long runs, that is in excess of 2500 ft., are involved. It is wise to incorporate in your planning sufficient conduit to run this coaxial cable to each classroom.

Switching techniques can be employed which will allow the program operator to control the programs which are fed to various rooms. With all systems, it is possible to take portable camera pickup equipment into a classroom and feed a program back to the studio from which it can then be distributed to other classrooms.

Considerable economies can be effected by proper cable use and we will be glad to offer consultation which will lead the architect to flexible and economic designs.

The third consideration is lighting. In the studio, provision should be made to illuminate the televised area to a minimum of 50 ft. candles. The best installation will be one that affords evenly distributed lighting.

Banks of 6 ft. fluorescent lights are most effective. Several 500-watt and 1000-watt flood and spotlights should be included. All lights should be mounted from ceiling hangers. There are many simple and inexpensive mounts available which will allow for simple adjustment of the light throw. Several floor mounted light fixtures will also be found quite handy. Typically, 500-watt spots can be used for this purpose.

Television can show closeups of processes and operations involving small objects or small areas.

A recently announced high efficiency lighting kit, known as the color trend unit, has been put on the market. This equipment provides high intensity illumination from ordinary light fixtures. Television units which are going to be used for portable work in the classrooms can be equipped with regular photographic clip-on type spot and flood lights. These are commercially available in 500-watt and 1000-watt sizes.

This is, of course, providing the optimum in lighting conditions. In the classroom, it is possible to pick up good programs where light levels are as low as 10 ft. candles.

The fourth consideration is receivers. Special closed circuit video monitors or regular television receivers can be used in the classrooms and various offices for picking up the programs. It is recommended that the commercial quality ruggedized industrial monitors be employed. Home television monitors do not produce as high a quality picture and will normally require an extensive amount of maintenance when utilized on a continuous basis under the conditions encountered in a closed circuit television installation.

It is a good rule of thumb to plan for one 21-inch monitor for every 20 students. Our studies have shown that this is the optimum size in grouping arrangement. If larger monitors are used, the picture is unsatisfactory for those students sitting close to the receiver. If a television projection system is used, the room must be completely darkened, which gives rise to the same problems encountered when showing regular movies in classrooms.

The receiver should be mounted 7 to 8 feet above the floor and should be provided with hoods so that overhead lighting does not wash out the picture.

The final consideration is that of electrical requirements. The television camera systems require approximately 750 watts per camera chain. They operate off standard 110 volt single phase 60 cycle AC lines. Television monitors will also operate off standard 110 volt circuits. Power requirements for lighting circuits can be calculated in the usual manner. It is advisable to provide a number of separately switched circuits in the studio, so that lights can readily be controlled from the floor. As an added precaution, it would be advisable to supply air conditioning in the studio area to compensate for the heat generated by the lights and associated electronic equipment.

An important program origination facility is the mobile unit or remote pickup unit. This can be very important to educational institutions or educational television stations, not only because it will permit televising from the classrooms, the laboratory, or the sports arena, but it provides a means of televising events of current importance as they actually happen.

These five basic considerations, then, form a framework within which to work. The many individual considerations can only be adequately handled by specific consultations.

QUESTIONS FROM THOSE WHO ATTENDED THE T-V DEMONSTRATION

Questions from the audience in both the Memorial Auditorium and the Little Theatre were directed to the consultants from Neely Enterprises, Dage, and KAY LAB. The consultants were: Robert E. Green, Di-

rector of Educational Television, Dage Television, Michigan City, Indiana; Jack Ingersoll, Manager, Neely Enterprises, San Francisco; Omar E. LaRue, Field Engineer in Charge of Educational Television, Neely Enterprises, North Hollywood, California; Jack Bannister, Field Engineer, Dage Television, Michigan City, Indiana; Edward Palmer, Field Engineer, Custom Electronics, Oakland; and Richard R. Silbermann, Vice President, KAY LAB, San Diego. Richard B. Lewis, Professor of Education and Coordinator of Audio-Visual Services, San Jose State College, San Jose, California, was Chairman for the presentations.

Silbermann: Those of us who have observed the work at San Jose State College and other similar institutions now using Closed Circuit TV as a teaching aid have experienced a moderate amount of frustration. This was due to the obvious initial reaction--here was a dynamic tool which offered great potential. But, on the other hand was complicated by the knobs, lights, cables, screens all of which raised the question, "Is this really compatible with the efficiency of expanding the teaching capacity?" The point that should be emphasized is that at any educational level, whether college, high school, or elementary school, a system can become involved with the use of television very simply. This was demonstrated by the use of remote-controlled cameras and one monitor. Normally, the equipment is not much more complex than what you would find in a home TV set. Educators can be using this tool. All the equipment that is available commercially is expandable. From a financial standpoint, it is recommended the program be started on a small scale. As the system grows the people who are using the equipment can expand their knowledge and develop new techniques for classroom demonstrations. At San Jose State College the training aids people who work with departments having a special need or interest in Closed Circuit TV programming are assisting in the development of some very effective teaching methods. The point should be emphasized that the program at San Jose State College today was not started with a complexity that would normally surround a TV station. On the contrary, it was started with a simple installation which provided them with a medium with which they could cooperate with other departments and develop teaching programs. I think that is the most important point.

Question: Where do you get the equipment that is cheap enough to start with?

Silbermann: Why, I think that from any manufacturer's equipment in the neighborhood of $2,000.00 to $3,000.00 one can start to use TV.

Question: It seems to me that there is not the clarity that you wish to have in the scientific demonstrations--maybe my question would be better if I said that if there was a keen lens that would bring in a close-up like at football games--is there such a thing?

Green: They have long focal lens for 16mm cameras and it will fit on the vidicon TV camera. When we were checking the system out last night I believe these gentlemen from KAY LAB had a 6" lens on one of their cameras and they expanded one inch on a ruler clear across the 21" TV monitor.

Silbermann: I think also that one of the most successful uses of TV has been in the science field--and generally speaking when you have a little science workshop set up with proper illumination and you have developed a little more familiarity with the equipment, an excellent job can be done. For example, in the University of Texas Dental School they use the cameras to project oral surgery. The whole mouth can be blown up to full screen size.

Question: How much training is necessary for an ordinary teacher to be able to utilize it?

Green: On either our equipment or this KAY LAB equipment--let me stop here a moment and say this--that I know of no manufacturer in this field that is turning out anything but good equipment, I think they are all to be commended for their work--they are all trying to do a decent job with it and they are all turning out very fine equipment. It is simple to operate. At Evanston Township High School in Evanston, Illinois the entire system, a very complex system incidentally, is under the direction of students who received about 18-20 minutes orientation before they started on the cameras and the camera controls. Now I would say this--that you should have available, if not on your staff, at least available in your community, a competent technician who could do some of the more complex work on this as far as maintenance is concerned. Maintenance is very small on any of this vidicon type equipment.

Lewis: Mrs. Martin and Mr. Over operated at Agnews using both Dage and KAY LAB equipment for many months with practically no previous training. They went right to work and they came in one day and said, "Incidentally, how can we show motion pictures over the TV?" And I said, knowing all about it, "It will cost you $4,000.00 and it can't be done." They said, "It can't be done? We've been doing it for two weeks and it works fine. We wondered how you are supposed to do it." They just set up a screen and took a picture of it and got a surprising picture of it. So, you see, this is the way you do it--it's that simple. If you don't know much about the inside of the machinery you can go ahead and produce television.

Question: In designing a new high school, what is the procedure to obtain information in order to get the proper design of conduit and other factors that influence the TV layout?

Palmer: Perhaps I can answer that. I'm a consultant to a group of architects in San Francisco. Now with regard to a medical set-up over there, they are planning on making some additions to their building and we are currently laying out conduit and the necessary connectors in that particular area. In the existing areas, since this equipment is transmitting power at video frequencies with not too much voltage, it does not require that the coaxial cable be placed in pipe; it can be just fished through the wall where possible, so it makes no difference. But it is simpler, of course, for a new building to put in conduit for the cables. It could be tied in to an existing distribution system, such as any master antenna system or it can be run strictly as video.

Green: I am sure that any of our representatives on the stage here, any of our engineering groups of either company or RCA or any of the people manufacturing this, would be very happy to meet with the architects and help lay out this system. There is one thing, of course, that the school must do prior to this, and that is to decide how they are going to use it and how elaborate they want to be. With this in mind, any of these gentlemen here or any of their representatives could assist an architect and a school board in designing a very flexible system.

LaHue: From the point of a new facility, I don't think any of us will deny that the impact of TV is bound to increase, and with a few very simple procedures one can assure that the system can be expanded; and one of the simplest expedients is that of being sure that there is a simple way to bring cable into every classroom because I feel that the day may not be now but maybe tomorrow when we will want to do that. So, as Mr. Green said, all manufacturers offer this service and many of us have developed little kits which are based on past experience. Fundamentally though, one should not, in a new facility, limit the consideration of TV with its uses that he imagines today because of the very stimu-

lating things about this business is that every day when you think you've solved all the problems, someone comes up with ten more new ones.

Lewis: Put some conduit in the building when you build it so you don't have trouble later--and that can easily be planned at this point.

LaHue: It will allow you to put on other circuits besides the video. I know of several installations where they have gone as large as 2"--but anywhere from 1/2 to 1" will work. If it is a 1/2" it might be slightly more inconvenient for the installer, if it is a 1" it will be a pleasant job, and if it is 2" he shouldn't be paid for it.

Green: In a viewing classroom I think that this size is quite adequate but in your control room facilities, depending upon your originating classroom from which you are actually putting this on, you should provide more conduit and more power because you are going to have to light this one particular room. Therefore, the type of conduit that will run to your viewing classroom can be at a minimum of 3/4 while in the originating classroom you should be more largely depending upon the facilities required.

LaHue: Many schools have taken advantage of the existing art facilities and the reason they have done this is that they didn't have regular TV studios available but conversely I'm not sure that this isn't a good idea to continue. One of the considerations here is that when you are planning a Theatre Art room such as this, to put additional facilities in this for feeding video from this room, and maybe bringing in a few more control functions and a place to hide all this behind a window or something and this quality of use, may end up with good economy. We have encouraged architects, where they seem to have a little space and money, to put a separate room in for TV.

Lewis: We are doing that at San Jose State College. We have a small TV studio especially designed for instructional purposes in the Theatre Arts Department and also the associated theatres around it where we can feed our programs and operate.

Silbermann: In the field of TV, beyond the single school use, I think that within the next few years we will be faced with some basic problems and the problems are going to be that, in a school district such as you might have here in the peninsula or we have in San Diego, you have a lot of schools that are growing rapidly, and your student population is increasing rapidly and there is a real desire to have a central audio-visual workshop at one point in the city and from this audio-visual workshop to distribute materials. In San Diego we have a problem that some of the national speakers won't come because we don't have an auditorium big enough to guarantee a large enough student audience. One of the techniques which has been discussed by the National Committee on Educational TV, Ford, and other interested groups is the possible use of the Educational TV channels in conjunction with the Closed Circuit facilities in schools. A very unique opportunity exists here which we have overlooked and that is basically this--that UHF channels which in many areas are assigned to educational regional institutions are not reaching the public because there are not many UHF sets. But they are ideal for Closed Circuit arrangements between schools. It is very economical to put up a low power UHF station complete with all the equipment--transmitter, and the works--for approximately $30,000 to $50,000 and in the various classrooms you would really have an antenna and ordinary TV sets. This is a potent weapon because it is a lot cheaper than trying to string cables to all these schools. And it is a lot faster than waiting for VHF channels. Any man who is planning a school or a whole school

district or thinking about the problems of school districts should think of that point because that is something we can do today.

Question: I'd like to hear some more about taping a picture on sound and also if there is any thought of three dimensional use of TV.

Silbermann: First of all, recording of pictures or video tape is bound to come. I know that both technically and cost-wise to the educator it might be 5-7 years off--to the educator in the secondary schools it is probably 10 years off. There are very economical ways, however, of storing picture information. There is an old-fashioned one we call movies--and this can be done from any one of these monitors. You can take a picture from it--kits are available for doing that--and a typical example for that is that you can have this film chain or the motion picture exchange set up in one room of a school building, and in that room you can have all of your audio-visual films. These films can be piped to all classrooms simultaneously or separately so that if you are in a large facility where you have duplicate classes, it can be done readily. As far as color is concerned, there is today color available for Closed Circuit use. The cost is still high but a very interesting thing that we have found, and I am sure other manufacturers have, is that in most instances the advantages of color are small--at least they are small compared to what you think they offer initially. Color is available; it is a matter of compromising the cost and the complexity of the equipment. Finally, as far as 3D is concerned, we and others have supplied this kind of equipment to the Atomic Energy Commission where they use manipulators instead of reactors; but again it is a matter of cost. 3D is available, it can be run, but it is surprising how much you can obtain from proper staging with two dimensional presentations.

Green: Certainly the audio-tape as you know it and the wide video tape is available now. The Ampex Company manufactures one that sells for $4,500.00 a unit. However, I'd like to point out one thing about it. This is a fine utilization for networks, broadcasters, and other people and some educational instances. But if you are going to prepare films, for instance the extension department is going to prepare films for utilization in smaller schools that will not have this available, then I think the kinescope recording is going to be around for a long time because a 16mm projector at the current price is certainly a lot less than $4,500.00.

CAFETERIA FACILITIES (Continued from page 66)

Most schools of some size employ a separate dishwashing machine to clean the trays.

Garbage storage and disposal must be provided for in some quantity at school cafeterias. Local regulations will determine whether garbage must be segregated into wet and dry classifications, but in any event, a fly-proof garbage storage area with easy access to the street for pick-up must be provided. Hot water and neoprene hoses are the usual method for thoroughly cleaning the empty garbage cans.

WILLIAM B. HIGMAN and DAVID E. MUFF
Graduate Assistants, School Planning Laboratory

INTEGRATED CONTROL (Continued from page 70)

the situation. Application is, in so many words, control--hence the entrance of control people into the integrated classroom. Control of the mechanical equipment in this classroom presented a challenge that could best be met by keeping one thought foremost in

(Continued on page 112)

San Francisco Examiner

Scenes From The School Planning Laboratory

INDIVIDUALS

AS WELL AS GROUPS RECEIVE EQUAL ATTENTION WHEN THEY COME TO THE SCHOOL PLANNING LABORATORY SEEKING ASSISTANCE WITH THEIR SCHOOL PROBLEMS. MRS. JEANNE HANNIBAL OF MENLO PARK, CALIFORNIA, IS SHOWING DR. GEORGE D. MINER, SUPERINTENDENT OF SCHOOLS, RICHMOND, CALIFORNIA, AND DR. MacCONNELL SOME FEATURES OF SCHOOL FURNITURE IN WHICH SHE IS INTERESTED.

No. 6

RANDOM CANDIDS FROM THE

INSTITUTE PHOTOGRAPHER'S FILE

DISPLAYED

EQUIPMENT

SCHOOL

ARCHITECTS

MODELS

EXHIBITS

MANUFACTURERS

DESIGNS

WHAT'S RIGHT WITH OUR SCHOOLS

WALTER W. OSTENBERG, Superintendent,
Salina (Kansas) Public Schools.

We get a lot of advice on how to run the schools. That is proper. We ought to get a lot of advice on how to run schools. Any organization affecting the lives of as many people as do the schools of this country should certainly be subject to criticism if it is of the proper kind.

Many people think that schools ought to be run just as they were a century ago. They think that we shouldn't change at all, in spite of the fact that everything else has changed. I recall reading about a man who had just reached the ripe old age of 100, and a reporter went to see him and said, "You must have seen a lot of changes in these 100 years you have lived."

The old gentleman said, "Yes, and I've been agin every one of them."

Now, let's take a look at the schools.

During recent years the American Public Schools have been under the most severe attacks in their history. Critical articles have appeared in newspapers and magazines, as well as one-sided investigations that have been made in some communities. Conclusions have often been made on the flimsiest of evidence. Fortunately, there have been articles in magazines and newspapers where the schools have been defended.

One of the great fallacies regarding schools is that twenty-five or fifty years ago schools were much better than they are today. Present day school critics insist that all students at that time could spell, read, write and work arithmetic exceedingly well. Youngsters were taught to work hard and didn't want something for nothing. They were loyal American citizens who believed in democracy. They behaved well at all times. They had a high regard for spiritual matters. These important phases of education are neglected today, so say the critics of the schools.

The truth is that schools have never been perfect and they are not now perfect. No intelligent person would assume that they are.

I think we are safe in saying that in recent years there has been a tendency to place too much emphasis on the weaknesses and imperfections in the schools and not enough on the virtues. We have overscold ourselves on our faults. There have been and are so many things right with the schools and a little further emphasis along this line seems in order.

Schools are judged by the products they produce and that is not an unreasonable premise. Certainly it is true that other agencies contribute their share to the total education of every boy and girl in this country. I refer to the homes, the churches, the many youth organizations which do such an excellent job in the total educational picture. I would be unfair if I did not also include the radio, television, comic literature, etc.

In order to judge fairly and honestly the work of the schools it is necessary to take into account a number of significant factors.

Schools have experienced two types of inflation--inflation in money and inflation in babies--since 1945 school enrollments have increased by about 8,000,000. Colleges and universities are not graduating enough candidates to fill the demands for teachers. There is a shortage of classrooms in many communities.

Salaries for teachers are still too low to compete with other professions. Recently I heard a prominent industrialist who was a member of a Citizens Committee in his own state. He said he had often been asked the question, "How high should teachers' salaries be?" He answered by saying, "I'm not sure what classroom teachers' salaries should be but I'd like to say to you business and industrial leaders of this state, that when classroom teachers' salaries are sufficiently high that you as parents will suggest to your boy when he is considering with you his life work that he should give some thought to the teaching profession, then we may be approaching the proper salaries."

With these facts in mind, how well are the schools doing?

Let me suggest that you read the series of articles in recent issues of the N. E. A. Journal, "Today's Schools Are Good Schools."

There is enough scientific evidence in these articles to disprove the criticisms of those who state that the schools are not teaching basic fundamentals. Time forbids a review here of these studies which have been made in many states. Suffice it to say that in every basic fundamental, with the possible exception of spelling, the youngsters of today excel the same age students of a generation ago despite enormously increased enrollments.

We tend to form hasty generalizations on the basis of the very small percentage who do not measure up. We cannot assume that there is no juvenile delinquency in our country. There is no use to pretend that because juvenile delinquency is distasteful to us, it doesn't exist. Because of the headlines in newspapers, magazines, radio and television there is a danger that we form distorted conclusions. We tend to judge the inconspicuous many by the notorious few who make the headlines.

Martha Elliot, Chief of the Childrens Bureau, recently wrote in the New York Times on one overlooked statistic. "Last year some eighteen million boys and girls between the ages of 10 and 17 were not picked up by police for any crime whatsoever."

The younger generation today is just as fine, decent, and honorable as any generation that ever lived. The few bad ones get so much publicity now we tend to indict the whole generation. Many times we have accused them falsely.

Our critics say that we don't teach fundamentals, that some students can't read, some can't spell, some can't work arithmetic. We shall have to admit that

in some instances the above assumptions are correct. The mistaken conclusion to which some people come is that they think every student of twenty-five or fifty years ago mastered all of these basic skills. That is a fallacy. The truth is that some students couldn't spell very well, some couldn't read very well, and some couldn't solve ordinary arithmetic problems fifty years ago. It has always been so.

In a recent magazine cartoon, a boy was showing his report card to his father, and he had his chest out. He walked over and said, "Here is my report card for you to sign. I just brought along one of yours that I found." He wasn't a bit embarrassed about his.

There was another cartoon in the same magazine. A boy finally got disgusted with his dad and said, "Dad, quit telling me about what Lincoln did when he was my age. When he was your age he was President."

Who plays on your football team? Who plays on your basketball team? Who sings in your choir? Who participates in debates? You don't ask them, "What does your father do?" You don't care what side of the railroad track they were born on. You simply say, "If you can play well enough, you are on our football team. If you can sing well enough, you are in our glee club. If you can play an instrument well enough, you are in our band." Democracy in action in the Public Schools.

I was delighted a couple of years ago when our senior class of Salina High School, numbering some 250 boys and girls, elected as their president the only Mexican boy in that class. They didn't care whether he was a Mexican or where he lived. They just thought he was a great boy, and he was, and they elected him president. That is democracy. You can think of thousands of illustrations like that, I know.

I was traveling from San Francisco to Kansas City during the war on the Union Pacific Railroad. I had the upper berth, and a man named Mr. Allen, from Des Moines, Iowa, a man about seventy years of age, I would judge, had the lower berth. We visited, as we rode across the country on that train, and finally Mr. Allen said this: "You know, I never cross these mountains and these deserts, the wastelands of Eastern California and Utah and Colorado, but that I don't renew my utmost admiration for the pioneers, the men and women who sat in front of their covered wagons with their guns across their laps and guarded their possessions by day and by night against wild Indians, against bandits, against the elements. They founded the empire of the West."

I said, "I agree with you completely. I, too, have that same admiration."

Then he said this, "You know, if the young people of today would have the same kind of courage, the war wouldn't last very long."

I said, Mr. Allen, up to now I have agreed with you, but no more. I know the young men of today. How much courage do you think it takes to fly a dive-bomber? How much courage do you think it took to land on the beaches of Iwo Jima and Salerno and Normandy and the thousands of other places you and I had never heard of before and have forgotten since? How much courage to man the submarines in enemy-infested waters, when you didn't know what moment you might be blown to eternity? How much courage did it take for the men in the trenches, amid the rocks of Old Baldy and Heartbreak Ridge? How much? Oh, the kids don't like war. They never have, but they go."

Carl Sandberg said it in a very blunt sort of way, when he wrote that great poem, "The Unknown Soldier." He said: "He picked up and died, when they told him to." They are still doing it.

Not too long ago I heard Mr. Schaeffer, vice-president of Boeing in Wichita, where they build the

B-47's, speak. He said the plane has a total of 56,000 horsepower. Fully loaded it weighs 185,000 pounds and flies 600 miles per hour. Just imagine--56,000 horsepower. The Super Chief on the Santa Fe Railroad has 6,000 horsepower.

Then he told of the 27 miles of wiring, the 1,000 vacuum tubes and the thousands of hours of research in order to design this modern plane. And it costs two and one-half million dollars.

The amazing part of Mr. Schaeffer's story is that a dirty-faced kid from your town or mine, a kid some people said wouldn't amount to anything is driving that two and a half million dollar machine.

Our schools haven't taught young men how to wage war effectively although many of them are in the armed forces now. But the schools have taught its students that every worthwhile thing in our country is at stake in any war. The schools, churches, homes and communities have never suggested to young men that they should love war, and let's hope that they never will. Youngsters don't like war and they never did but they recognize their obligation to serve in the armed forces, not because they like it, but because they know it is a stark, compelling necessity. Loyalty comes from parents, church, community and school. Lasting loyalty cannot be taught in a few hours. It comes from repetition in conversation and in formal teaching; it comes from an intelligent understanding of our type of government. The schools will continue to emphasize the teaching of democracy. School people recognize that democracy has lost favor in many parts of the world. It is a matter of deep chagrin to all Americans that Russia has been able to sell slavery more effectively than we have been able to sell freedom in many parts of the world.

The schools have never taught a blind, unintelligent patriotism but one that will stand the closest scrutiny of intelligent thinking. The schools have never wavered and never will waver in their confidence and devotion to America and its institutions.

Let me repeat. Schools in many places are crowded. Some teachers are not as well qualified as they should be. Let's admit that we have made some mistakes in educational theory and practice. But a careful study of the schools today will produce plenty of evidence that education today is the best it has ever been.

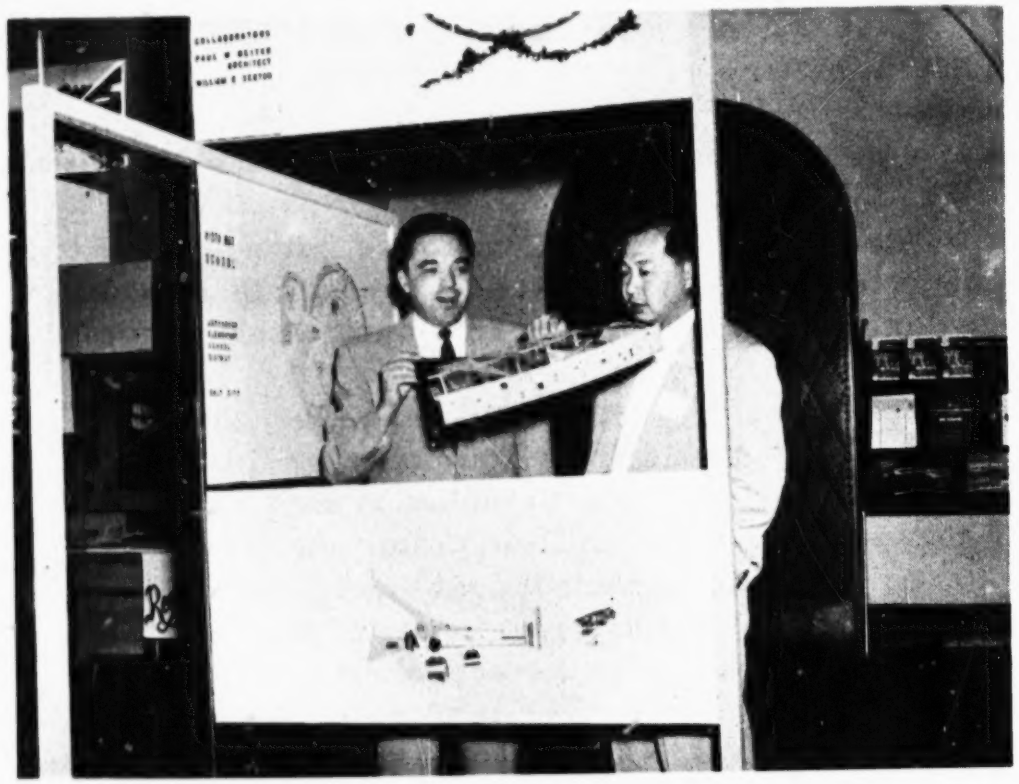
INTEGRATED CONTROL (Continued from page 110)

our minds, "Will the teacher and pupils benefit the most from this type of application?" We have known for some time that to approach the mechanically perfect classroom it would be necessary to include visual, acoustical and thermal treatment of the room.

A control system which will automatically and positively combine these three factors is the only sure method of producing the environment within the classroom which will be most beneficial to learning and teaching. In the control of the master plan, our first step was to analyse the problem and break it into the following sub-steps--control of the heating and ventilating equipment, control of the artificial lighting and control of the skylighting devices to provide sufficient darkness in the classroom for audio-visual instruction. In approaching the problem step by step it became merely one of combining different features of applications we already had in the field. We have already combined the requests of architects, engineers, school administrators, teachers, and maintenance personnel in producing a temperature monitoring system known by the trade name of "Schoolmaster."

Through discussion and interviews it was decided that, while temperature monitoring was highly desirable, a method of resetting the classroom temperature following an unfavorable condition detected by the monitor panel was necessary. Hence, the addition of an electronic reset panel composed of scaled potentiometers such as the one on the panel. We then had a temperature control system, mentioned earlier, that would relieve the teacher of all obligations insofar as resetting the thermostat, opening and closing windows--in simple--of all temperature and ventilation worries within the classroom. We had, literally, improved the conditions for learning by providing a thermal environment within the room which were, in our estimation, most beneficial to that process.

This system would provide positive temperatures determined by precision instruments rather than by the individual desires of the teaching personnel. Our second problem of artificial lighting lent itself to application of an electronic photo-cell. Since we are assured even distribution of light throughout the structure regardless of sun position we are able to measure outside light intensity and calibrate the introduction of artificial lighting accordingly. By relaying the photo-cell detection through an electronic panel we can position a rheostat located within the panel to give sufficient artificial lighting within the room to maintain a pre-determined foot candle reading at the task level.



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